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TG51

USABILITY OF WORKPLACES
Report on Case Studies

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Usability of Workplaces
Report on Case Studies

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Task Group 51: USABILITY OF WORKPLACES

Background

Introduction

Usability is one of the most important, but most often neglected, aspects of building performance. Work to apply these concepts in building design, construction, management and use is in its infancy. A new CIB task group (TG51) was formed in April 2002 to apply concepts of usability, commonly used in the fields of consumer products, IT and engineering, to provide a better understanding of the user experience of buildings.

The task group has been formed with the commitment of the following research-based partners:
Laboratoire Espace de Travail, La Villette, Paris, France
Norwegian University of Science and Technology (NTNU), Trondheim, Norway
Chalmers University, Gothenburg, Sweden
University of Salford, Greater Manchester, UK
VTT, Transport and Buildings, Helsinki, Finland

Each research-based partner facilitates the involvement of a cluster of 'industrial partners', representing different stakeholder perspectives as owners, occupiers and operators of buildings and workplaces.

The work of the task group proceeds through a programme of action research, comprising an intensive series of case studies and associated workshops, in association with occupying organisations, to produce research findings within a 'business' timeframe, to satisfy a practice audience, and to identify the scope for further collaboration amongst research partners.

This paper sets out the aims and objectives of the research, clarifies some of the key terms and concepts and describes the exploratory case study framework that has been created in workshops held amongst the research partners. Five case studies and workshops that comprise the first phase of the research programme have been completed and reported and initial findings and conclusions presented.

A Theoretical Framework

Research on the evaluation of buildings has some widespread and valuable component internationally. *'The Serviceability Tool',* created by Gerald Davis et al [1], is acknowledged as one of the most widespread practical and theoretical vehicles to evaluate building performance. Davis distinguishes between **performance** and **serviceability** [2]. He argues that: 'Serviceability is about whether a building or facility is **capable** of performing as required.

/…./ whilst Performance means actual behaviour in service at a given moment.' Davis' definition of performance acknowledges the importance of the **situation**.

He also appreciates that human preference, such as the notion of satisfaction, is important as it is stated in the ISO standard for the concept of usability (ISO 9241-11). He also defines serviceability as a broader term than performance, which indicates that his interpretation of satisfaction has a general meaning and is not connected to individual values dependant on situation, context and time.

The characteristics of the concept serviceability, as it is defined by Davis et al and adopted by most students of the field, is that serviceability and hence performance is causally tied to functionality. In Davis' reasoning, serviceability is synonymous to usability in the meaning it has in ISO 9241-11.

Another important contributor to the field is Wolfgang Preiser, who is one of the foremost figures in developing Post Occupancy Evaluation (POE) techniques [3]. POE is a technique strongly tied to performance. POE is traditionally a technique that is used after a building is in use. Preiser has however in recent writing indicated different types of POE – indicative, investigative and diagnostic [4]. POE and Davis´ Serviceability Tool are two competing methods to evaluate and rate buildings in relation to the intended use. They are both focused on observing and measuring certain physical aspects of the building or the facility and evaluate that in relation to the intended or actual use.

Functionality can be defined as a property given to an artefact in order to create a *practical effect* [5]. An important effect can be described as *usability* [6]. Product designers suggest two categories of functionality; *technical functionality* and *interactive functionality* [5]. Technical functionality is defined as those properties given to the artefact that makes it do the job in itself - *operational functionality,* but also those properties given that makes the artefact work as a part of a larger whole - *structural functionality*. Interactive functionality is described as *ergonomic functionality* and *communicative functionality* and is about those properties of the artefact that interact with users of the artefact. Ergonomic functionality refers to all those properties of the artefact that affect the more tangible relations between man and the artefact. Communicative functionality on the other hand deals with the more subtle effects that the form and aesthetics of the artefact have in terms of supporting meaning, values, identification or sensory aspects.

In ISO 9241-11 three factors are described that determine usability. *Efficiency* means that the artefact allows the users to perform with ease and with little use of resources. *Effectiveness* describes the ability of the artefact to deliver a certain desired effect. The third factor is *satisfaction* that describes the users feeling and attitudes to the artefact and its effects.

Functionality alone does not make a certain artefact usable. The technical and physical properties of the artefact and its theoretical potential to deliver a certain effect do not automatically make it usable in the real world. As a result of the definition of usability it also depends on the *situation* in which the artefact is used, the *context* the artefact is designed and used in and the *values* of the designers and users. Both context and values change with *time* and *place*.

Consequences of Gap in Theory and Practice

In cross-cultural situations, national, ethnical or corporate differences, could cause misunderstandings, bad decisions and serious loss of time and money. Effort could be invested in buildings and work place design that are not as effective and sustainable, from an economic, cultural and human point of view, as they could be. Even more though it could cause mistrust, lack of commitment and loyalty, which in turn could cause lower productivity,

less creativity, loss of customers and personnel turnover or absenteeism in user organisations.

Several studies have shown that, at least in some situations, participation in work place design is a powerful vehicle to development of the work organisation and learning in organisations [7,8,9,10,11]. Swedish practical findings and international collection of case data by professor Vivian Loftness at Carnegie Mellon and research done by Michael Brill of BOSTI in US [12] also shows that the negative economical implications on productivity might be tenfold the saving on work place costs if done wrongly. This risk is especially high in knowledge organisations where commitment and trust is crucial to staff performance.

The Usable Workplaces Project

Aims and Objectives

The aim of the project is to promote, develop and share methods, processes and techniques for the evaluation of buildings-in-use, in particular, in the workplace and, in particular, to investigate the concept of *usability.*

The agreed objectives of the task group are:

to conduct out a series of case studies and associated workshops, involving users, practitioners and researchers in a programme of action research
to develop concepts of usability for application in practice
to promote, develop and share methods, processes and techniques for the evaluation of buildings-in-use;

The project is not an investigation of what makes a building usable or not, but is a theoretical exploration of different aspects of the concept. As described above, the concept of usability is traditionally closely tied to the concept of *functionality* and almost regarded as a causal effect of it. We like to follow the thoughts introduced by Davis' in the concept of *performance* that is tied to the usability in a given moment. We therefore suggest that usability is a time, place, context and situation bound concept. The aim of this investigation is to elaborate the components of the concept usability.

A better understanding of the concept will be useful not only in evaluation of buildings already in use but also a better understanding of what might be relevant knowledge to include in the briefing process of design.

The above discourse on the definitions of functionality and usability must be made operational in the real world. This is done through the planned set of case studies that we perform in the project. An important step is therefore to reflect on every case to determine whatever the definitions of functionality and usability are usable and helpful in real life situations to guide briefing for buildings and help in post occupancy evaluation of build space. Another aim is to use the cases to further enrich and elaborate the definition of the concepts for a better theoretical understanding.

2.2 Organisation of the Project

Five countries currently participate in the TG51 working group. The UK is represented by Salford University with NCR, Powergen and the Royal Bank of Scotland as industrial partners. Sweden is represented by Chalmers University of Technology with Örebro University Hospital. Finland is represented by VTT in collaboration with Turku Polytechnic and the Old

Mill Business Centre. Norway is represented by NTNU, SINTEF and Stattsbygg and France by the Ecole d'espace de travail, La Villette, Paris, with Renault as a partner.

Each country contributes with a case that is presented and examined in a workshop. The evaluation is a self-evaluation made by the company in co-operation with the local researchers. The aim of the evaluation is to describe the actions taken, decisions made and qualities included in the project to arrive at a usable solution. The evaluation also includes a review of the usability of the building in use. The sources for this investigation are documents, interviews and observations of the kind that are used in quick ethnographical methods. The evaluation is documented in a draft report to the whole group. This report is the foundation for a workshop where the evaluation is discussed and challenged by the other participants. The outcome of the workshop is input to a final report of the case.

The aim of the case evaluation and the workshop is to find aspects of the concept of usability. As every case is different and belong to different contexts new aspects of the concept is highlighted in every national study. An early provisional and somehow rudimentary understanding of the concept is developing and become more and more elaborate with every workshop.

Research Methodology

As the aim of the investigation is the understanding of a complicated concept rather than finding common quantitative evidence of a certain phenomenon, a qualitative and practice grounded method was used that the researchers have long experience of.

If the aim were to find common knowledge on what properties makes a building usable, the investigation would proceed from a traditional quantitative point of departure. However, as the intention here is to expand the understanding of the concept usability, in order to get a common understanding of a meaning that can serve as guidance in as many design and evaluation situations as possible, the situations of investigation have been chosen in quite another way. From a similar project, investigating the multiple aspects of 'the importance of spatial design to work place performance', an appropriate method has been developed for this kind of research.

The first component of the investigation is to fuse practice and research together in the development of understanding. Theory developed from practice and theoretical reflection on and structuring of practical understanding are the cornerstones of the investigation. The creative process of investigating and reflecting on common situations between research and practice is essential. This method of developing innovative new concept that challenges existing theories as well as proven practice has been successful in earlier project. In 1980 Granath participated in the innovation of a new production system that at the time was challenging existing state of the art and resulted in new theories in the area as well as the innovative automotive assembly plant for Volvo in Uddevalla, Sweden [7].

The second component is the combination of self-evaluation by practice and a selection of quick ethnographical research methods. In the almost ten years long thematic network, the 'workspace project' [13], a case based method was developed that will be described in details below.

The third important component is choosing situations from different cultural contexts like countries, companies and industrial branches.

Like the workspace thematic network [13], this project is a co-operation between a number of countries represented by researchers and companies from different disciplines.

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Task Group 51: USABILITY OF WORKPLACES

Final Report

Introduction

This paper reports on activities and reviews the work Task Group 51 Usability of Workplaces completed in phase one of the project, sets out an outline programme for a second phase and attaches a proposal for continuation of the programme of work in a Working Commission on Usability.

All the current members of the task group support the proposal and have confirmed their commitment to a further programme of work, based on the established modus operandi. One new member has joined the network and committed to provide a case study and host a workshop. In anticipation of the changed status to a Working Commission, preparatory steps have been taken to extend the network to broaden the international outreach. Two new, international members have already indicated their intention to participate in Phase 2.

Final confirmation of membership and commitment to contribute to and fund the programme of work will follow acceptance of this proposal.

Review of progress

Achievement of objectives:

The original objectives, set out in the proposal for the task group have been fully met

Objective	
to develop concepts of usability for application in practice	General concepts of usability, applied to the built environment, have been adapted and used in case studies to evaluate usability in different building types;
to conduct a series of case studies and associated workshops, involving users, practitioners and researchers in a programme of action research;	A series of three four case studies have been documented, presented and discussed in participatory workshops involving a mixed group of stakeholders;
to promote, develop and share methods, processes and techniques for the evaluation of buildings-in-use;	Methods for evaluating usability at different stages of the life cycle of a building have been identified and their effectiveness assessed in-use, through the case studies.

Task group membership:

The following organisations participated in the task group in Phase 1.

Research-based partners:
CFM, University of Salford, Greater Manchester, UK
Chalmers FM, Gothenburg, Sweden
NTNU, Trondheim, Norway
SINTEF, Trondheim, Norway
Laboratoire Espaces-Travail, La Villette, Paris, France
VTT, Helsinki, Finland
Turku Polytechnic, Finland

All of the current members of the task group have confirmed their commitment and have agreed to continue to support the programme of work.

Industrial partners:

The following industrial partners have provided case material, participated in workshops and continue to support the task group through the research-based partners.

NCR, UK
Powergen, UK
Royal Bank of Scotland, UK
Landstingservice Örebro, Sweden
Old Mill Business Park, Finland
Renault, France
Statsbygg, Norway

Co-ordination:

Professor Keith Alexander is the co-ordinator of the task group and the School of Construction and Property Management (SCPM), University of Salford has provided the Secretariat.

Programme of activities:

The proposed two-year work programme envisaged a collaborative programme of case studies and workshops and an annual symposium to consider and discuss results of usability case studies, together with a programme of dissemination and publication.

Over a period of almost three and half years, the Task Group met on 9 occasions, with a further two case studies and workshops scheduled over the next three months. The members each committed to conduct a case study and host a workshop and to meet all the associated costs of the participation of the other members (apart from travel costs).

8 April 2002	Exploratory meeting, UK
16/17 December 2002	Planning meeting, UK
5 April 2003	Research meeting, Portugal
14/15 November 2003	Workshop 1 – Lake District, UK
16/17 December 2003	Workshop 2 – Orebro, Sweden
19/20 April 2004	Workshop 3 – Turku, Finland
20/21 May 2004	CIB World Building Congress, Toronto, Canada
6/7 September 2004	Workshop 4 – Paris, France
27/29 September 2004	CIB W70 meeting – Michigan State, USA (cancelled)
7/8 December 2004	CIB W70 meeting – Hong Kong, China
14/15 February 2005	Workshop 5 – Levanger, Norway
13/16 June, 2005	Task Group meetings, Joint CIB International Symposium, Helsinki

A Usability Symposium planned for Manchester in the Autumn of 2005 will now form part of the programme for Phase 2 of the project.

Outputs:

Conference papers:
Alexander, K, Fenker, M, Granath, J A, Haugen, T I and Nissanen, K, (2004), 'Usable workplaces: research in progress', Paper to the CIB World Building Congress 2004, Toronto, Canada, May 2004;
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Jenso, M, Hansen, G K and Haugen, T I, (2005), 'Usability of buildings: theoretical framework for understanding and exploring usability of buildings', Paper to CIB W70 Meeting, Hong Kong, November 2004;
Jenso, M and Haugen, T, (2005), 'Is patient focus leading to usability in hospital buildings?', Paper to CIB W70 Meeting, Hong Kong, November 2004;
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Nenonen, S and Nissenen, K, (2005), 'Usability walkthough in workplaces – what, how, why, when?', Paper to CIB W70 Meeting, Hong Kong, November 2004;

Case Studies:
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Hansen, G K, Haugen, T I, Janso, M, Knudsen, W and Tennebo K, 'Nord Trondelag University College, Nylana, Rostad, Norway', February 2005;
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Huovala, R and Alexander, K, 'NCR Discovery Centre, Dundee, Scotland', October 2003;
Lindahl, G, Hinnerson, J and Granath, J A, 'Orebro University Hospital: the O-building, Orebro, Stockholm, Sweden', December 2003;
Nenonen, S, Nissenen, K, Porkka, J and Huovala, R, 'Old Mill, Turku Business Park, Finland', April 2004;

Web pages:
www.cfm.salford.ac.uk - project intranet, available to members only.

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13 September 2006

Executive Summaries

1. Executive Summary: Case study - NCR Discovery Centre, Dundee, UK

The investigations around the usability concept are focused on the relocation of NCR's Global HQ of Research and Development to a purpose built premises in Dundee, Scotland. Relocation involved, as the first project in Europe, the design tool Community Based Planning (CbP). Evidence for relocation processes and activities which would support NCR in achieving more usable workplace was sought.

Specific emphasis was placed on the ways of gaining the knowledge of business objectives as well as users' activities, needs and communication patterns; and translation of these to a workplace settings and services. Data was to show the qualities of the workplace solutions, in terms usability: usefulness, adaptability, flexibility, functionality that is used, accessibility and ease of use. Data of the outcome measurement was collected, in terms of efficiency, effectiveness and satisfaction. NCR's previous R&D facilities were perceived outdated and spatial solutions were not seen to support research and development activity. R&D is constantly under competitive pressure and development of new, innovative, solutions is vital for success and pressures to continue to lead the market. Therefore need to support more efficient development processes was recognised in NCR.

The two main drivers for the relocation were the desire to provide a 'world-class' environment for the development of innovative product design; and identified retention problem. £20 million was invested for this new facility. Objectives for the relocation were:
- To separate the R&D from manufacturing, due to differences in the working cultures
- To bring together R&D activities that were distributed into 3 location, and within locations, different parts of the building
- To provide a 'World Class' office environment to support innovation and development of new products and to attract graduates
- To create more manufacturing space (Old R&D facilities converted back to manufacturing)

The involvement of staff was seen very important, because NCR wanted a significant change to their working environment. Traditionally this would have been very much a top-down approach where people had to adapt to what was given to them. However, in the R&D relocation it was decided that people had to be provided with an opportunity to get involved, partly from democratic reasons, but mainly to add value to the outcome and avoid design errors by finding out their requirement from the space.

NCR employed an external service provider to manage the change along with designing appropriate layouts and providing the furniture. The design process of Community Based Planning (CbP) was perceived to meet these criteria best by emphasising the need to understand the business and its people and their activities as well as treating the users as co-designers.
CbP process included various data collection methods, from leadership surveys and interviews to questionnaires and workshops engaging majority of NCR's R&D staff. The data collection enabled the furniture supplier (who were also designers and change managers) to identify the main business objectives for the space; better understand the

working culture and communication patterns within and across teams; identify specific spatial needs for different activities; and identify the current satisfaction rates in terms of the use of space.

Frequent communication in various levels was integral part of this relocation process. To provide a platform for communication, different types of groups were formed including: the steering group, leadership group, co-design groups, middle-management group and all staff as a one big group.

The purposes for communication varied from strategic decision-making and co-designing to reporting back the progress of the relocation and suggested design ideas. The communication was mainly lead by the furniture supplier.

Post-occupancy measurements were carried out six months after the relocation, which indicated improvements in business dynamics (communication, learning, decision-making, innovation and work processes) as well as increased people satisfaction. The relocation process was perceived to be very successful and NCR feel very proud of their new R&D centre.

The workplace processes, such as meetings and walk-throughs involving FM and the steering, were put in place to ensure the space was supporting the business. However these faced out fairly soon after the move and were perceived as a final stage of the relocation (to check everything was finished), rather than an on-going activity. Lack of communication and need for more formal processes for the space management, especially for the internal moves, have been recognised by both, FM and the business.

After the relocation, NCR have had to deal with cost reductions, which have significantly affected also the facilities management practice. The FM strategy changed from co-locating the activities through consolidation to cost cutting, reducing the head counts in support services, increasing the density and outsourcing the Facilities Management.
User's involvement in a later relocation process (another R&D group relocation to the Discovery Centre) had to also be limited. Reasons for this was perceived to be the cost reductions and therefore lack of choice in the possible furniture and lay-outs. Although staff involvement and communication were identified as success factors in the R&D relocation process, there is very little evidence that these principles have been implemented to the ongoing workplace management.

Questions to consider:
1. What qualities in the process enabled usability in this case?
2. What were the barriers (if any) in the process to achieve usability in this case, how could have these been avoided?
3. Will the user involvement enable usability?
- Importance of early user involvement in design and service procurement?
- Possible risks associated with lack of involvement and communication?
- What impact top-down approach in workplaces processes can have on usability?
4. Attributes of the workplace – what evidence is there for usability in NCR?
- Usability qualities: usefulness, adaptability, flexibility, functionality that is used, accessibility and ease of use.
5. What should be the criteria for usability – usefulness of assessment?
- Is this usability criterion right in terms of representing usability of workplaces – what other information needed?
- Usefulness of measurement for usability: efficiency, effectiveness and satisfaction?

- What is the business benefit in achieving usability of workplaces?
- From whom and how should the evidence for usability be collected?
6. How important is it to adapt the change management processes of the relocation to the ongoing Facilities Management?
- Changing from traditional top-down approach to shared decision making and then back to top-down approach again – what risks associated – How does this affect achieved usability?
- Roles of Facilities Management and roles of the business units in adapting processes?

2. Executive Summary: Case study – Old Mill, Turku, Finland

The third European workshop of the CIB51 Task group – 'Usability of Workplaces', is arranged in Finland. The associated case study focuses on the elements of usability in a refurbished working environment of Old Mill Business Park. The Old Mill is located in Turku Science Park area and offers services as well as functional and interesting premises with an atmosphere of an old factory for ICT companies. The floor space is 15.100 sqm in four floors. The case-report includes the illustration of the Old Mill in the context of creating a brand. The brand, in fundamental level, includes usability and it offers a way to describe the quality of the building. The aim of the case study has been to analyse the existing status of usability. The analysis is undertaken in two phases – 'Diagnose' and 'Discussion' - and the third phase – 'Dialogue' - is being proposed.

The diagnosis phase consists of a workplace survey in the form of a questionnaire. The diagnosis indicated the areas of low usability. After this, the 'usability walk through' was organised in order to get more information about the low usability as well as discuss about the ways to improve it. Third phase is under development – the intention is to set the information got collected through diagnosis and discussion to the context of future requirements of the building. The tool for this dialogue phase is software Ecoprop.
The status of usability Old Mill is quite high, but some areas of improvement have been identified.

The aims include:
- customer orientation in the car parking area (serviceability),
- 'smarter' (multiple) use of the entrance hall - focus on different options and communication of these to the users in order to encourage them to use this space more efficiently (learnability)
- efficient use of the restaurant lunch buffet by improving the logic of the layout (functionality)
- Better guidance of the ways the meeting rooms are used. amount of information for the use of meeting rooms (functionality)
The learning points of the case study are
- the intangible character of brand is a relevant way to approach usability
- the dissatisfaction management is a good starting point to investigate where the usability can be increased
- the user experience has an emotional background: this fact of subject is important to keep in mind during the ways to gather information
- the results of the usability surveys has to be handle as a part of process, not only as frozen facts and figures

The case study focused mainly on the common areas in the Old Mill. The individual workstations were not considered in this phase. The future challenges include the use of EcoProp to create the usability profile in the shared facilities of Old Mill , but also in the occupying organisations
-with their own brand and user requirements
- within the Old Mill and the Science park.

3. Executive Summary: Case study – Technocentre Renault in Guyancourt, La Ruche, France

This is the fourth workshop of the CIB51 – Usability of Workplaces. The object is the vehicle design and development centre of Renault - Technocentre Renault. The study focuses on the occupation of one specific building – the Ruche – where more than 4000 people work in product and process engineering.

The report is based on interviews with management and staff from the operational division of Vehicle Engineering Development and interviews with actors in charge of facilities management, building design process and workplace strategies.
The management considered the implementation and use of the Technocentre as an essential part of its change strategy in vehicle design and development. This led to a very ambitious approach both in the architectural and landscape treatment of the site and in the way the building / facilities management has to support ongoing change by which the organization seeks to adapt and improve its processes.

The case study examines the way the organization occupies and manages the Ruche. Then it questions the perceptions of benefits within the organization based on the experience of use. It turns out that the learning process – knowledge about the building and its possible uses – is an important aspect of the perceptions, of the way the organization actually use the building and of the way it envision change.

The draft report presented during the workshop on the 6th September is intended to give a first idea of the case and the analysis. The complete and final version will be developed after the discussions of the workshop.

4. Executive Summary: Case study – Nord-Trøndelag University College, Nylåna, Røstad, Norway

This is the case study report for the fifth workshop of the CIB TG51 – Usability of workplaces. The object for this study is the Nord-Trøndelag University College at Røstad (HiNT), and the building Nylåna.

The building was finished in 1999, and is housing the General teacher education, Pre-school teacher education and the Nursing education section. We also find the common library, canteen and auditoriums for the University College here. Since the building was finished 6 years ago, the number of students starting their studies at the Røstad campus, has increased by 1000 from 1500 to 2500.

In this report the concept of usability is discussed, looking at the different perspectives considering usability during the different phases of the planning process to the building in use. In the introduction, we give an overview of different factors inluencing usability from

Norwegian standards and legislation. As part of the Norwegian contribution to the project, we take the development of the theoretical framework of usability of buildings in the CIB TG 51 a step further.

This case is studying the consistence of the planned and the completed building, and the building as it is today, 5 – 6 years after handling over. This includes how the different users like students, teachers and other staff evaluate the usability of the building and the validity of the planned building related to the situation today, and from the perspective of change.

The report and findings are based on project documents, interviews with 4 key actors in the planning and construction process. For evaluating the building in use, the findings are based on interviews, workshop including a walk-through and a user survey among students and staff using the building.

For the survey we used a standard building questionnaire developed by Building Use Studies, to benchmark this building against a greater number of UK buildings. Looking at aspects concerning the planning and construction phase, we have only 4 interviews to base the findings on. Still we have some indicators on conditions that could have an influence on whether the result is good or bad in a usability perspective. The real process being investigated is discussed and seen in the light of the planned process (the procedures and routines).

The findings from the building in use show a building that works quite well, considering the different aspects of usability. The survey gave an extraordinary high score compared with earlier UK benchmarks results. The Nylåna building came in the top 3% of the dataset using a wide range of user performance criteria. The comments in the questionnaire, the interviews and the workshop/ walk-through gave however a more nuanced picture, with special weight on problems regarded to the high number of students, complains about ventilation and temperature in specific areas, and a need for more group and seminar rooms. But all in all, the findings from the different methods being used are quite corresponding. In general we find that the users interviewed are quite satisfied with the building. Surveys made on a national scale also show that the students perceive the university college at Røstad as an attractive place to study.

5. Executive Summary: Case study – Örebro University Hospital: O-Building, Sweden

This is the second workshop of the CIB51 – Usability of Workplaces series. The object is a surgery and radiology building in the University Hospital of Örebro in Sweden. The building was finished in 1997 and is used generally the same way as it was planed. The case-report is based on interviews with management and staff in the medical departments, both those who participated in the design process and those who did not. Interviews are also made with representatives of the Real Estate Department that was in charge of the design process and is now owners and caretakers of the building.

The architectural and usability ambitions with the building were high. The technological level is very high both when it comes to medical processes and from service engineering point of view. The building has got separate installation floors and some rooms are constructed as Faraday's cages not to disturb sensitive medical technology.

The culture of involving staff in design of their workplaces is very old in the County and dates back to early seventies. Also in this project the process of participation has been very ambitious. Despite a number of controversial issues during the design phase the acceptance and satisfaction of the building is today high. The end of this case report is a discussion on the concept of Functionality and Usability. To make these concepts operational the experiences from the case is used. By doing this it becomes obvious how aspects of usability can be affected by the organisation of design and the design process itself.

Case study: NCR, Discovery Centre, Dundee, UK

November 2003

CIB Taskgroup 51

USABILITY OF WORKPLACES

Case study: NCR, Discovery Centre, Dundee
Draft report

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1   SUMMARY

The investigations around the usability concept are focused on the relocation of NCR's Global HQ of Research and Development to a purpose built premises in Dundee, Scotland. Relocation involved, as the first project in Europe, the design tool Community Based Planning (CbP). Evidence for relocation processes and activities which would support NCR in achieving more usable workplace was sought. Specific emphasis was placed on the ways of gaining the knowledge of business objectives as well as users' activities, needs and communication patterns; and   translation of these to a workplace settings and services. Data was to show the qualities of the workplace solutions, in terms usability: usefulness, adaptability, flexibility, functionality that is used, accessibility and ease of use. Data of the outcome measurement was collected, in terms of efficiency, effectiveness and satisfaction.

NCR's previous R&D facilities were perceived outdated and spatial solutions were not seen to support research and development activity. R&D is constantly under competitive pressure and development of new, innovative, solutions is vital for success and pressures to continue to lead the market. Therefore need to support more efficient development processes was recognised in NCR.

The two main drivers for the relocation were the desire to provide a 'world-class' environment for the development of innovative product design; and identified retention problem. £20 million was invested for this new facility. Objectives for the relocation were:

- To separate the R&D from manufacturing, due to differences in the working cultures
- To bring together R&D activities that were distributed into 3 location, and within locations, different parts of the building
- To provide a 'World Class' office environment to support innovation and development of new products and to attract graduates
- To create more manufacturing space (Old R&D facilities converted back to manufacturing)

The involvement of staff was seen very important, because NCR wanted a significant change to their working environment. Traditionally this would have been very much a top-down approach where people had to adapt to what was given to them. However, in the R&D relocation it was decided that people had to be provided with an opportunity to get involved, partly from democratic reasons, but mainly to add value to the outcome and avoid design errors by finding out their requirement from the space.

NCR employed an external service provider to manage the change along with designing appropriate layouts and providing the furniture. The design process of Community Based Planning (CbP) was perceived to meet these criteria best by emphasising the need to understand the business and its people and their activities as well as treating the users as co-designers.

CbP process included various data collection methods, from leadership surveys and interviews to questionnaires and workshops engaging majority of NCR's R&D staff. The data collection enabled the furniture supplier (who were also designers and change managers) to identify the main business objectives for the space; better understand the working culture and communication patterns within and across teams; identify specific spatial needs for different activities; and identify the current satisfaction rates in terms of the use of space.

Frequent communication in various levels was integral part of this relocation process. To provide a platform for communication, different types of groups were formed including: the steering group, leadership group, co-design groups, middle-management group and all staff as a one big group. The purposes for communication varied from strategic decision-making and co-designing to reporting back the progress of the relocation and suggested design ideas. The communication was mainly lead by the furniture supplier.

Post-occupancy measurements were carried out six months after the relocation, which indicated improvements in business dynamics (communication, learning, decision-making, innovation and work processes) as well as increased people satisfaction. The relocation process was perceived to be very successful and NCR feel very proud of their new R&D centre.

The workplace processes, such as meetings and walk-throughs involving FM and the steering, were put in place to ensure the space was supporting the business. However these faced out fairly soon after the move and were perceived as a final stage of the relocation (to check everything was finished), rather than an on-going activity. Lack of communication and need for more formal processes for the space management, especially for the internal moves, have been recognised by both, FM and the business.

After the relocation, NCR have had to deal with cost reductions, which have significantly affected also the facilities management practice. The FM strategy changed from co-locating the activities through consolidation to cost cutting, reducing the head counts in support services, increasing the density and outsourcing the Facilities Management.

User's involvement in a later relocation process (another R&D group relocation to the Discovery Centre) had to also be limited. Reasons for this was perceived to be the cost reductions and therefore lack of choice in the possible furniture and lay-outs. Although staff involvement and communication were identified as success factors in the R&D relocation process, there is very little evidence that these principles have been implemented to the ongoing workplace management.

Questions to consider:

1. **What qualities in the process enabled usability in this case?**
2. **What were the barriers (if any) in the process to achieve usability in this case, how could have these been avoided?**
3. **Will the user involvement enable usability?**
   - Importance of early user involvement in design and service procurement?
   - Possible risks associated with lack of involvement and communication?
   - What impact top-down approach in workplaces processes can have on usability?

4. **Attributes of the workplace – what evidence is there for usability in NCR?**
   - Usability qualities: usefulness, adaptability, flexibility, functionality that is used, accessibility and ease of use.

5. **What should be the criteria for usability – usefulness of assessment?**
   - Is this usability criterion right in terms of representing usability of workplaces – what other information needed?
   - Usefulness of measurement for usability: efficiency, effectiveness and satisfaction?
   - What is the business benefit in achieving usability of workplaces?
   - From whom and how should the evidence for usability be collected?

6. **How important is it to adapt the change management processes of the relocation to the ongoing Facilities Management?**
   - Changing from traditional top-down approach to shared decision making and then back to top-down approach again – what risks associated – How does this affect achieved usability?
   - Roles of Facilities Management and roles of the business units in adapting processes?

Content:

2   FOCUS AREA

Usability approach is presented through the process of designing a workplace. The first European project, involving the design tool Community Based Planning (CbP), was carried out in NCR's new built R&D centre, which was completed in 2002.

The NCR case study focuses on the attributes of the working environment achieved through the workplace design process, and their contribution to achieving usability. The value of continuous user participation and shared decision-making power to enable integration of the business needs to the workplace design are demonstrated through the case study.

3   INTRODUCTION

3.1   NCR

NCR -- originally National Cash Register – is an international company and provides technologies designed to enhance interaction among customers, suppliers, partners and employees. NCR was founded in 1884 and the company was built around the philosophy of concept of continuous innovation and the view that "a product is never finished". (Annual report 2001)

NCR are dedicated to being a world-class provider of Computer Products and Services to customers in all industries. The company leverages its expertise and market presence to provide computer solutions to its targeted industries. The company-wide competitive advantage is clear: innovation, creativity, and continuous improvement.

3.2   NCR in Dundee

NCR's Scottish operations have changed dramatically over the two decades. What began as a cash machine manufacturer in 1884 made the move from mechanical engineering to mechatronics (the combination of mechanical engineering, electronics systems and manufacturing) in the 1970s and finally on to the software engineering.[1]

NCR's factory in Dundee was established over 50 years ago, when the primary activity was manufacturing. The research and development organisation gradually expanded during the 1980's. The company employs about 1600 people in Dundee, from which 500 are research and development staff.

According to records held by city of Dundee, NCR increased sales in 2002 more than 20% and 30% of world's cash points were manufactured at NCR's plant in Dundee. [2] Reasons behind the continued success of NCR in Dundee have believed to be the focus and creative strength of its research and development activities**,** investing in its people, as well as available, flexible and caring workforce and excellent educational facilities.[3]

3.3   Research & Development

NCR has 500 R&D associates who carry out tasks from product development and supply line management to marketing and customer and sales support. The activities include team meetings (formal and informal), project work, quiet work, light physical work, client presentations and prototyping. The facilities needed to support these activities include dedicated desks, project rooms, informal and formal meeting areas and product design labs.

Research and development activity is constantly under competitive pressure and development of new, innovative, solutions is vital for success. Pressures to continue to lead the market, and therefore need to support more efficient development processes, was recognised in NCR.

> "Our lifeblood is in the ideas and creativity of our development engineers and we need
> to provide an environment where successful projects can be nurtured and flourish."
> **Danny O'Brien Vice President of NCR Financial Solutions Group**

> "Our industry is rapidly changing and only the successful innovators, and those who
> constantly strive to do things better, will survive"
> **David Ramsay, NCR Vice President Global Operations**

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[1] *Mark Grossi, the head of the company's advanced concept lab in Dundee.*
   (May 2002, http://www.interactivetayside.com/news/news_detail.cfm?news_ID=243)
[2] (2002, http://www.dundeecity.gov.uk/cofd/industry.html)
[3] May 2002, http://www.scottishengineering.org.uk/pressreleases/15%20May%202002.doc

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3.4   Relocation

The majority of 500 R&D associates were previously located on the top floor of main production facility, Gourdie Factory, which had been gradually converted into an office space. However, the research and development activity was still distributed in 3 different locations around Dundee.

The R&D facilities in the Gourdie Factory, however, provided outdated appearance and spatial solutions which were not seen to support research and development activity. NCR had understood that: "the traditional, 'three person buckies' were not the best way to promote team-building and team effort"[4]. This view was supported by NCR's global, annual, occupants satisfaction surveys, which had indicated problems with cleanliness, noise and lack of creativity. [5]

In 1999 the decision was made to improve R&D facilities. The main driver for the relocation was the desire to provide a 'world-class' environment for development of innovative product design. Identified retention problem with software engineers was another driver. £20 million was invested for this new facility.

3.5   Property portfolio

Global:
NCR have a substantial Real Estate portfolio divided into four regions: Europe, Middle East and Africa (EMEA), Americas (Americas), Japan (Japan) and Asia Pacific (AP). This expands to 700 properties in 70 countries, with assets ranging from manufacturing facilities to sales and marketing offices.

As a solutions company with a relatively small manufacturing base most of the 150 annual new-build projects are small call centres, country offices and so forth. However approximately 10 to 15 projects per annum (globally) are substantial in nature both in scope and complexity. These projects vary from large warehouses to new manufacturing facilities.[6]

Dundee:
NCR is located in outskirts of Dundee where they currently have three facilities, which are all on the same site:

- Main Production Facility Gourdie Factory	355,305 ft2	(33,043 m^2)
- Craigowl Dispenser Factory	57,359 ft2	(5534 m^2)
- Discovery Centre R&D Facility	133,056 ft2	(12374 m^2)

The two factories were purposely built for manufacturing in 1960's. When the research and development organisation later expanded, more and more parts of the manufacturing plant were handed over to the R&D offices and labs. The Discovery Centre was purposely built to accommodate the research and development department, the building was completed in 2002.

3.6   Facilities Management

3.6.1   Strategy

The facilities Management strategy at the time of the relocation (1999-2001) was rationalisation and consolidation of buildings within Dundee area. Since the relocation of R&D organisation to the Discovery Centre was completed, the strategy has been cost reduction. The cost reduction is emphasised globally in NCR and in all areas, not just in FM. In Dundee cost reduction is carried out in three areas in Facilities Management:

1.   Outsource Facilities Management

Outsourcing of FM has taken place in most parts of NCR worldwide. So far the Dundee site has been unique, because of the parts making facility and the PCB assembly facility, located in Dundee, for which a lot of mechanics and technicians were working. These departments have now been outsourced, and in that sense Dundee is no longer Unique. This will mean that the FM services, which in June 2003 had 29 staff will, beginning of next year (8 months later) have 3 staff.

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[4] Ray Robertson, NCR FM Director – "Welcome to the Discovery Centre"- leaflet
[5] Ray Robertson, NCR FM Director - interview
[6] source: project brief –furniture procurement

2. Reduce the cost/sqf by increasing the density

In the Discovery Centre, as in the global head quarters, focus of cost reduction is on reducing the cost/sqf by increasing the density. This is a global strategy and is aimed to be implemented in the Discovery Centre within the next year, or sooner.

'This will impact many of the activities in the Discovery Centre and will involve a lot of work in planning the layouts and setting them up and allocating these to the people. Already it can be seen that people have not been responding well to the changes and the increase of the density will mean that a lot of people won't be responding well to be having to move around.'[7]

3. Review the support services

The services will be reviewed, once the outsourced Facilities Management is in place:

'At the Gourdie Factory, which is an older building, there has been services that have been running for several years, and FM is now investigating these contracts and in many cases we are aiming to reduce them, for example in terms of head count' [8]

3.6.2   Structure and services

Currently there is 26 in-house staff in the Facilities Management organisation, made up of:
10 facilities technicians, 7 management, 5 office services, 2 labourers, 1 joiner and 1 secretary/administrator

The main outsourced support services include: Cleaning, catering, security, window cleaning, landscaping, snow clearing, forklift maintenance and PAT testing. The contracts are typically 3-year contracts (Some of the contractors are currently working on an extension with a 3-months notice period, until the outsourced FM will take place and review the services)

Facilities Management is divided into three management services and projects:
-    Customer Services and projects
-    Facilities Management and projects
-    Property management, office services and projects

	Customer Service	Facilities Management and projects	Property management, office services and projects
Number of staff	14	3	7
Key responsibilities	- Control of contractors operations and supervision - Technicians training, supervision and control - Facilities front desk support	- Building maintenance, repairs and alterations - Grounds maintenance - Space planning support - Health and safety - Waste management - Records management	- Space planning - Lease management - Budgets - Utilities contracts - Office services - Security - Provide technical support - Facilities Response desk support
Support activities	- Customer focused co-ordination of day to day activities - Review/renew all maintenance agreements - Development of facilities services - Compliance and record keeping - Continual monitoring of performance against set objectives	- Facilities survey - Benchmarking - DC Post occupancy support –includes - Cleaning contract renewal - Environmental audits - Warrant and planning applications	- Leasing arrangements - Energy management - Department budget compilation and forecast - 2003/2004 space planning and Office services strategy - Engineering consultancy

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[7] Source: Jim Adam, Head of Facilities Management, Oct 2003
[8] Source: Jim Adam, Head of Facilities Management, Oct 2003

4   RELOCATION PROCESS OF R&D

4.1   Stakeholders

CRE/FM defined the process and procurement strategy. In strategic level CEO, top management were involved, and a 'Steering Committee' was launched to lead the project. FM was chosen as the project manager. The Steering Committee involved all Senior managers (BU managers), FM Director, Supplier, end users.

Furniture supplier was expected to consult on change management, and therefore, had a major role in the relocation process as well.

4.2   Building needs - Developing the brief

Before the R&D relocation, majority of NCR's space management standards came from America, which were very much status based. This idea was questioned in the beginning, before the building was procured, and the aim was to design a building based on the needs rather than a status. Therefore, CRE and FM, in co-operation, began to look at the solutions that would improve the business processes by designing a workplace that would match these processes. As a result of this, NCR developed 'Villages' - concept that would introduce new forms of working in these spaces. The following principles to provide this concept could be identified from the furniture procurement brief:

1. Need for highly flexible and fluid working environment, such as mobile working areas and workstations
2. Need for team areas, and individual working areas
3. Development of service centres, which house quiet areas, photocopying, meeting rooms, centralized printers, IT closets if required, other services areas if required and everything necessary to service the villages.
4. Separation of villages to provide privacy and to control the noise.

4.3   Objectives

Objectives for the relocation:
- To separate the R&D from manufacturing, due to differences in the working cultures
- To bring together R&D activities that were distributed into 3 location, and within locations, different parts of the building
- To provide a 'World Class' office environment to support innovation and development of new products and to attract graduates
- To create more manufacturing space (Old R&D facilities converted back to manufacturing)

4.4   Process framework

Main stages of the relocation, could be identified from the material collected:
1. The process started with recognising the need
2. Investment decision was instigated in Dundee and approved via Head Office
3. FM and top management developed a brief for the building procurement
4. Choice of location
5. Building procurement and beginning of the building design (Following the corporate procurement process)
6. FM and top management developed a brief for the furniture procurement
7. Furniture procurement - Community based planning (in the beginning of the building construction) (following the corporate procurement process)
7. Start of the building construction
8. Identifying the business need – Georgeson and leadership team (CbP phases: uncover)
9. Identifying people activities and communication patterns – Georgeson lead questionnaire, workshops and observations (CbP phases: discover)
10. Identifying spatial needs (CbP phases: explore)
11. Pilot office was set up and observed by Georgeson
12. Implementation of space
13. Expanding the current service providers into the new facility
14. Move into the building from Gourdie Factory
15. Post-occupancy survey 6 months later

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4.5   Choice of location
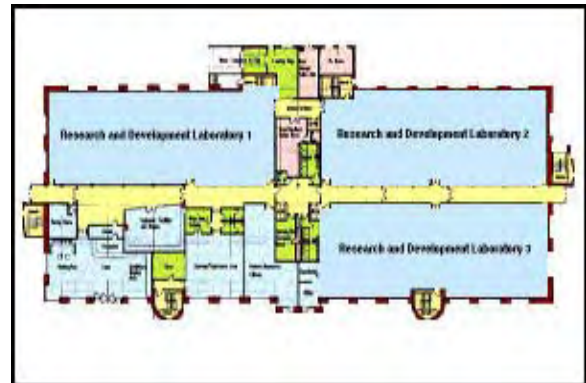
NCR wanted a campus approach and the land was available near the current site, therefore this was a natural choice for the location and no search matrix was needed to be developed.[9]

Location in Scotland also meant: the access to Scottish universities, which was seen to have impact on the research and development works; A good transportation network; Availability of land and buildings for industrial growth; Good industrial relations; as well as availability of commendable support services from the private and central government. [10]

4.6   Building design

The procurement of 148000 ft² (approx) comprising Research, Development, and Marketing Offices, together with all associated support areas that were required in the brief, was made before any major communication with staff was carried out. At this point the relocation project was still very much top-management lead.

The project was to provide shell and core areas for subsequent fitting out by the tenant's contractors. The initial layout was to divide the floors space into four separate areas. The construction period was 15 months from contract commencement

The floor plan[11]

4.7   Office design

While NCR was desirous of introducing new concepts and a state of the art method of working, the project objective (as presented in the furniture procurement brief) was to fulfil the needs of the end users with regards to furniture within the budget, while providing a highly flexible and pleasant working environment. [12]

4.7.1   Involvement of staff

The involvement of staff was seen very important, because NCR wanted a significant change to their working environment. Traditionally this would have been very much a top-down approach where senior management would determine the appropriate amount of space needed, followed by The Facilities deciding how the desks would be laid out and the space allocated according to the status. Therefore, traditionally people had to adapt to what was given to them. [8]

In the R&D relocation it was decided that people had to be provided with an opportunity to get involved and have their say, partly from democratic reasons, but mainly to add value to the outcome and avoid design errors by finding out their requirement from the space. [8]

> *'From the change management point of view, more you can involve people
> in the change the smoother the change will go through'*
> **Ray Robertson, NCR**

4.7.2   Furniture procurement brief

NCR asked two global furniture suppliers to present their ability to meet the brief and to provide a process to best fit with NCR's work processes.

According to the furniture procurement brief, the selection criteria was based on the service provider's ability:

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[9] Ray Robertson, NCR, October 2003
[10] Dr. Jim Adamson, NCR vice-president (DC Thomson & co Ltd, 2002, http://www.dcthomson.co.uk/courier/fdap/fdap18.htm)
[11] Source: http://www.jameskeillerestates.com/
12 Project Brief – company document

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1. To provide a FULL service, including needs analysis, furniture solution, consultation with end users, budget management, design, manufacture, installation and operation.
2. To undertake change management and the 'selling' of the concept to the end users and persons who will occupy the building.
3. To demonstrate generic responses to the flexible and fluid 'village' concept -provide 'out of the box' solutions while maintaining the integrity of the building and meeting the corporate space standards
4. To demonstrate generic responses to the service centres, including furniture arrangements and room designations
5. To carry out some areas of the interior design work.
6. To provide detail listing out the steps necessary to deliver this full service and a timetable/schedule detailing these steps and the approximate timeframes for each task. (This schedule must be compatible with the master schedule)

4.7.3   Response to the brief -Community based Planning

Furniture supplier / workplace consultant, Georgeson, met the criteria best by presenting the workplace design process of Community Based Planning. The process is based on people connections, which strengthen business dynamics by facilitating learning; improving communication; optimising work process; increasing innovation and developing decision-making.

The process allows designers to uncover and understand the informal networks that constitute the way people work, learn, innovate and communicate in the workplace by studying information collected about how individuals, teams and communities interact and manage their information. Most importantly, the users of the space become co-designers in the planning and design process. [13]

The 'Community Based Planning'- process is developed by Steelcase, and their service supplier Georgeson carried out the project for NCR. 'Community based Planning'-process involved six steps[14]:

1. **Prepare:** To determine suitability and fit to the process
2. **Uncover:** To identify critical business issues with the leadership
3. **Discover**: To diagnose organisational health, to gain valuable insights into NCR culture and to identify key people within the networks within NCR.
4. **Explore**: Looking into findings from the data collection and analysing the problems, translating solutions and engaging users to the design process. The restructuring the space and defining new work settings starts in this phase in order to solve the problems the business may have in its working environment and culture.
5. **Implement**: Designing the space considering the impact the work processes, Human Resource, Technology and space have on improving the business results.
6. **Measure:** To engage users to ensure the current working environment meets the users' needs. Post occupancy evaluation results to be compared with the pre-evaluation and network analysis. Measuring organisational health.

4.7.4   Communication

Frequent communication was an integral part of the workplace design process. Different types of groups were developed throughout the project (Table 1). Forming of the Steering Group was initiated by NCR's HR, right in the beginning of the process. The Leadership Group was also formed in the beginning of the project to support the collection of data and communication in a more strategic level. The purpose of communication in the levels of the whole group, co-design groups and management groups was to communicate ideas and raise discussion and get feedback on the future ways of working (such as working in a open plan) specific to the groups.

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[13] Georgeson presentation
[14] Georgeson presentation

Type of group	No. people involved	Frequency	Purpose	Activity
Steering group	12 - Formed by NCR, initiated by HR. Formed with middle management within departments	Monthly	Georgeson to update the group with progress, group communicating back to their teams	Meetings with Georgeson
Leadership group	12 senior managers	3 times (beginning and twice to present the insights of data collection)	- Present the insights of the data collection - Identify business issues and establish strategic objectives for the new R&D facility - Approval of design ideas went through the leadership group	- Strategic intent - workshop and report - Business dynamic evaluation –before and after - Georgeson presentations and presentations with Georgeson to the whole group
Co-design groups	500 divided into 12 groups (which were divided into smaller groups within co-design sessions)	3-4 times with each group	At first, to present the findings from e-tool questionnaire specific to the groups and to explain the benefits of working differently. Later to communicate design solutions specific to this group.	Photos taken of likes-dislikes, comfortable places, where you meet
Whole group	500	3 Kick off, half way and before move	To communicate the CbP process and progress in design for everybody.	Leadership and Georgeson carried out presentations
Manager group	30-40 Included all department managers.	3	Formed due to increasing concerns the management about new ways of working, for example, working in an open plan office.	Formal presentations to explain advantages of open plan working

Table 1. Groups formed during the relocation project

Additional to communicating with the specific groups, there was also other means of communication (Table 2), such as NCR's internal Magazine and Internal TV screens. A Pilot office was also built to the old office space to demonstrate the kind of work setting to be created in the new office. Pilot was aimed to be as realistic as possible - partition walls, carpets, lighting, furniture, technology and storage space - were all put in place. The pilot was set up to support the design stage of specifying furniture, technology etc. mentioned above.

A project team was asked to volunteer to use the space for six weeks - a group of 12 software engineers volunteered. The team was to log their comments on the Intranet, so that everybody could see them. After six weeks (intended time) the group wanted to stay in the pilot settings until the move. Another pilot was also set up 4 weeks later with a group of 10 hardware engineers, because they felt that their needs might differ from the software engineers. This experiment was set up for few weeks only and removed when it was tested an approved to fit the needs of hardware engineers as well.

Mean of communication	Volume	Frequency	Purpose
Spotlight magazine (NCR's internal)	6	Every 2 months	To inform the progress of relocation and response to general concerns rose through communication with people.
Internal TV	Throughout the building	All the time	Showing presentation on insights of data collection and progress in the project
Pilot office	Teams of 12 and 10 worked on these settings. Co-design groups taken to view the pilot settings	Available all the time	To create similar settings to the future office. Team of 12 volunteered.
Site visits	Co-location teams	3 weeks before	Show the new facilities, where they would be working, and how the space worked
Intranet	During the pilot office	During the pilot office	Staff working in the pilot office setting were to log their comments on the intranet

Table 2. Additional means of communication

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4.7.5   Collection of data

To enable designers to better understand what kind of spatial solutions would best support the business and the R&D activities, series of studies were carried out in the beginning of the CbP process, before any decisions of internal lay-outs were taken. However, the building was already been designed, Georgeson had an opportunity to change the layout to more open plan. (Instead of dividing the floor space into four, it was divided into two large open plan areas).

The table 3 indicates the main methods to collect information from different stakeholders and the timing and purpose of the data collection:

Tool / method	Stage of process	Participants	Purpose
Business dynamic card	Right in the beginning and 6 months after	12 people - Leadership team Results presented to leadership only	To identify present and admired, and pre occupancy, influence key business dynamics (pre defined) have on leadership vision. Dynamics: communication, learning, innovation, decision-making and work processes.
Leadership interviews	Right in the beginning	12 people - Leadership team Results presented to leadership only	To identify the main issues and goals for the new R&D centre (concerning issues like culture, trust, communication, organisation – Table 4)
Activities, needs assessment[15] Approx 80 questions	Beginning	- All 500, including leadership - Response rate before: 80% - After: 70% - Results presented to everybody	To identify what kind of: - spaces are used, how often and for what purpose; - storing in place
Pre / Post occupancy satisfaction* 26 questions	Beginning and 6 months after	- All 500, including leadership - Response rate before: 80% After: 70% - Results presented to everybody	To indicate importance of and satisfaction with (for example): - environmental conditions; - appropriateness of space to support activities; - feel of working environment generally
Communication network* 6 questions (Network analyses)	Beginning and 6 months after	- All 500, including leadership - Response rate before: 80% - After: 70% - Results presented to leadership only	To identify patterns of communication: - general discussion about work - source of advice - problem solving - idea exchange - who to sits next to
Interviews with key people	Once in the beginning (after e-tool questionnaire)	30 people – 'gate keepers' based on network analyses, or volunteers	To collect data on NCR' team structures; and collaboration and interaction between the teams
Photo survey	Beginning	NCR staff was asked to take photos of things such as: their likes and dislikes, comfortable areas, places to meet etc.	To collect data on how people perceive their current environment
Shadowing	Beginning	Georgesons' observations	To collect data on how spaces used
Post interviews	6 month later	12% population (approx. 60) representing all groups in Discovery centre – sample group identified from network analyses (key gate keepers) Results presented to everybody	15 key issues addressed, relating to: accessibility, communication knowledge sharing, pride productivity, diversity of settings easiness, satisfaction

Table 3 Data collection methods and purpose

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[15] Part of the e-tool questionnaire, involving 3 parts and approximately 112 questions

4.7.6   Defining the workplace needs - the business aims

From the 'Business Dynamic Cards' it could be defined that the '*innovation*' was the main business driver, '*decision-making*' was to be improved the most and that the '*Work processes*' needed the least improvement and was also ranked to be doing the best out of five dynamics.

From the leadership interviews Georgeson identified some key issues, which enabled to define the goals for the project in more detail. The following table shows some examples of these issues and goals[16]:

	Leadership comments	Georgeson's interpretations of goals
Culture	- Manufacturing mentality - Clock watching - Cost as a measure of efficiency - Schedule takes over quality - People key to success - Culture can work against change	- Innovation needs to be recognised - Flexi time needs to be business focused - Need to show employees they are valued - Culture need to be understood leveraged in the new building
Organisation	- Hierarchical - Cross team working - Teams change often	- Need to consider functional v cross functional organisation - Need to consider hierarchy and networks in spatial solutions
Communication Collaboration	- Current space is restricted - Poor flow of communication from bottom to top - Close links to other sites needed	- Need to provide spaces that encourage better communication - Technology will be used to link the separate buildings - Need to provide flexibility
Work processes	- Cross functionality to support team working - Process times must be shortened - No time for creativity - Inefficient circulation - Team working benefits from dedicated spaces and flexibility	- New spaces will be designed to foster creativity - Appropriate technologies and HR activities must be enacted
Innovation	- Inefficient - Lack of creativity - Manufacturing legacy is a barrier	- Speed to market is main factor of success - Spatial solutions to enhance innovation
Learning	- Lack of desire to learn - Knowledge held by individuals	- Two way learning and open communication will develop intellectual capital
Attract and retain	- Need to pay more to retain staff - Need to attract graduates	- New building should say ' our people matter'
Technology	- Lack of infrastructure to support multiple locations - Systems not interactive	- Linking multiple locations is a key
Change management	- Need to cut meeting by 50% - Informal meeting spaces considered as 'non-working' spaces - Need to recognize teams rather than individuals - Need for change management	- Using informal interaction to decrease meeting times - Reward and recognition based on individual and team work - Protocol for the new facility
Trust	- Hiding mistakes - Wont move forward unless we take risks - Fears of hidden agendas relocation process	- Issues around risk and site closing will be addressed

Table 4. Issues and goals identified by Georgeson

Interviews with leadership also helped to define main objectives for the relocation. The relocation process was seen as '*an opportunity to change the culture and space*' as well as an opportunity to '*motivate and energise the people*'. The new building was to give people '*ownership, mobility and accountability*' and was to '*represent NCR globally*' as a '*world class R&D facility*'.

Leadership also addressed concerns of '*not raising expectation too high*' and the '*equal treatment*' of different locations in Dundee. Which emphasised the need for careful management of communication.

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[16] Source: Georgeson presentation. Some quotations summarised.

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4.7.7   Defining the workplace needs - know the user and task

In the beginning of the design process Georgeson carried out a questionnaire survey (as presented in the table 3) to find out about:

- Basic user profile data: Profile; how long with the company; How long in a current position; highest level of education completed; age group; position (supervision responsibilities)
- Activities and tools used: Work location; Tools and technology; Storage needs; Individual needs;
- Working with others: Information management pattern
- Interaction and collaborative networks: Network analyses

Through the questionnaires and other data collection, such as photo survey and shadowing, Georgeson could identify the nature of current working environment in R&D department.

The satisfaction survey showed that people perceived the space was generally moderate. However, more was clearly required form the space, as the current and desired figures differed a lot in most issues. The survey shows that the most people wanted improvement for their personal workspace, such as privacy for concentration. Acoustic problems were also to be identified, which is most likely to be reason for lack of concentration. Availability/ existences of private areas as well as team working areas were also limited.
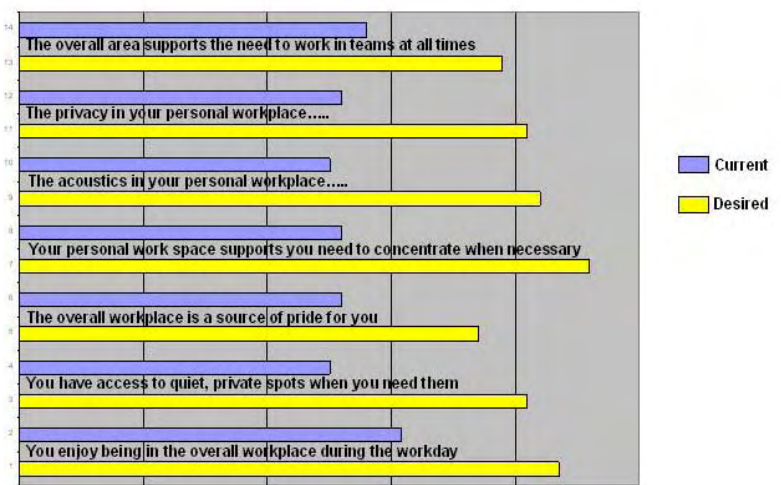
Figure 2. Pre satisfaction rates

Other identified issues concerning the spatial solutions were:
- Everybody has their own desks
- Lack of consistent structure for access, display, storage and retrieval.
- Limited availability of private areas
- Limited availability of team working areas
- Facilities were outdated, especially meeting areas
- Lack of signage makes it difficult to find people
- Lack of flexibility in the layouts
- Buckies hindered knowledge transfer (physical barrier)
- The working environment did not support co-located work
- There was a lack of appropriate space to support decision-making and knowledge sharing, which was seen to hinder work process.

Data collected about the way in which people worked showed that:
- 80 - 90% of people mainly work on the computer or talk on the phone.
- 58% of the people mainly work at their workstation,
- 30% stay in the building and
- 4-8% work outside the building and some other location.
- Informal interaction was happening in corridors
- There was isolated pockets of learning

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5   WORKPLACE SOLUTIONS

5.1   Spaces provided

The R&D centre currently has various space settings. All employees have their own dedicated workstation, however, following shared spaces were created:

- Team spaces
- Decision suites
- Quiet booths
- Garages
- Restaurant
- Neighbourhoods
- Breakout areas
- Touchdown
- Formal meeting
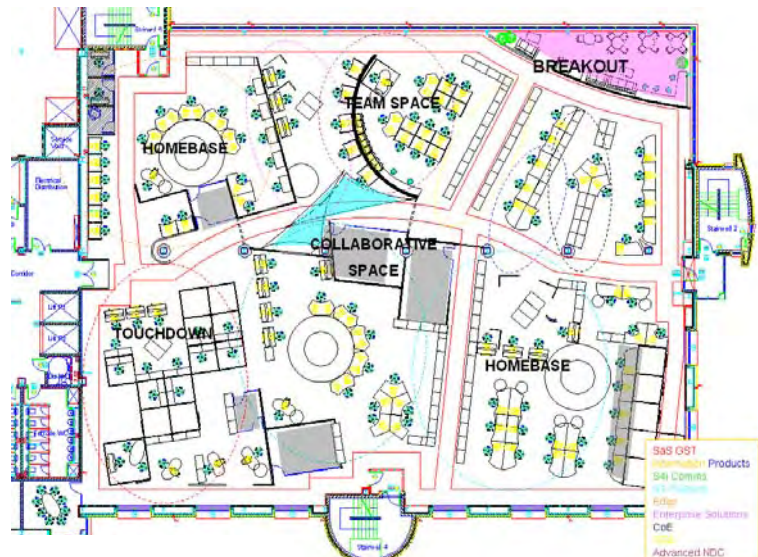
Figure 3. Typical floor plan

Georgeson have indicated that instead of having permanent areas for meetings, flexible furniture allows companies to create temporary space where groups can meet, present, work on team projects. Mobile elements, for example allow people to pull together at any time to create a meeting space and reconfigure when the meeting is finished.

5.2   Protocols

Georgeson, together with the steering group, developed protocols for the use of space:
- Shared spaces are for everyone
- Private enclaves are for temporary use
- Always assume the next group to use a room will include customers
- Allow any member of the team to signal the need for privacy at their workstation or in a meeting
- Keep public postings up to date

In addition to these protocols it was emphasised that the primary requirement is to meet customer needs, not to be at your workstation all day. Therefore - 'Be accessible if you can't be present. If you can't be around for an entire day, identify a backup. Change voicemail responses daily, if possible, and check for messages often. Behave the way you want others to behave around you. Working closer together demands co-operation.'[17]

5.3   Support services in place

The support services in place at the Gourdie Factory were expanded to the Discovery Centre. Therefore, there were no special criteria developed for selecting support services for the Discovery Centre and staff had no impact in selection of support services. The services provided are as described in the section 2.6.2.

Recording and monitoring: Service Level Agreements (SLA) are included in the security, cleaning and catering contracts. However, the SLA's are very much based on the expected activity rather than outcome or quality based. (Outsourced Facilities Management is expected to develop SLA's further)

Other than SLA's, there is no formal mechanism to record support services in place. Helpdesk deal with the enquiries and complaints, but there is no formal recording or monitoring of this.

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[17] Georgeson presentation

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NCR was going to carry out a customer satisfaction survey in the canteen to cover the areas of hygiene, cleanliness, choice, and value for money, to enable to charter and measure these numerically. This would have helped to identify, for example, top five favourite meals. The idea was to take a cross selection of employees, around 40-50 people, to complete the survey once a week, for certain period of time. Positive survey results would have been meaningful data when there are claims of deteriorated catering services. This survey, however, has not taken place due to lack of time and money.

Service Providers themselves do not have formal mechanisms for customer satisfaction surveys. Catering services, however, carry out satisfaction surveys from time to time.

5.4 Workplace processes in place

Some workplace processes could be identified through the interview (Oct 2003):

Business and FM: Steering group, which was formed for the relocation project, was to meet regularly with the Facilities Management to raise issues within the working environment and to make sure the facility met the expectations.

Village Bobbies: Some members of the steering group were selected as 'village bobbies' to occasionally tour around a dedicated area and monitor the cleanliness and tidiness and report back to Facilities Management of identified problems.

Internal moves: Initially it was set up so that the business managers or the 'Village Bobbies' were to be responsible of managing the desk moves. Managers were to discuss amongst themselves how to relocate teams of individual members of teams and when possible move the desks around or then contact Facilities Management to carry out bigger physical moves.

Facilities Survey: NCR has a global Facilities Survey, which measures satisfaction with the building services; Building Appearance and Image; Business Support Services; and Facilities Management Services performance. Part of the CbP the assessment of the workplace solutions was carried out (using CbP questionnaire) since then there has been no measurement of user satisfaction with the working environment taken place.

5.5 Success of the workplace solutions

As a part of the Community based Planning, Georgeson carried out surveys and measurements of the business dynamics and the user satisfaction. These were both carried out before and after the relocation, which enabled comparison with results and indication of admired improvement.

5.5.1 Business dynamics

NCR assessed business dynamics before the move as followed:
- Innovation was the main business driver
- Decision-making was to be improved the most
- Work processes needed the least improvements and were also ranked to be doing the best out of five dynamics.

The results after the relocation was as follows:
- Innovation had increased by 50%
- Learning had increased by 75%
- Communication had increased by 14%
- Decision-making had increased by 150%
- Work processes had increased by 14%

5.5.2 Satisfaction

The satisfaction questionnaire, carried out before the relocation was repeated six months after the relocation, with 70% response rate. Also interviews with 12% of staff (approx. 60 people who had been identified as 'gate keepers' in the network analyses) were carried out. The sample group represented all groups in the Discovery Centre.

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Instead of presenting the post questionnaire results directly in comparison with the pre-occupancy survey, the key issues from both, questionnaire and interviews were identified and presented to NCR. The following satisfaction rates were identified:

1. Increased face-to-face interaction and informal communication (decrease on formal communication and email activity)	100 %
2. Restaurant used as a hub of activity throughout the day	96.2 %
3. Easier to communicate to people in own group	90.6 %
4. Better access to meeting rooms	86.8 %
5. Management and experts more accessible	86.8 %
6. Knowledge is shared more easily (positive eavesdropping, impromptu interactions, common processes)	83 %
7. Easier to accommodate and integrate visitors and consultants across neighbourhoods	79.2 %
8. Impromptu meetings helping decision making process (faster and better informed)	79.2 %
9. Workplace became a source of pride and a reference for visitors	79.2 %
10. Diversity of settings increase productivity and degree of satisfaction with the workplace	77.4 %
11. Increased team membership and identity (neighbourhoods)	75.5 %
12. Easier to network with people from other groups, speeding up decision making and knowledge sharing	73.6 %
13. Need to provide for appropriate technology in different work settings	66 %
14. Need to improve corporate information across organisation	64.2 %
15. Need to provide for training in technology and protocols for space use	64.2 %

5.5.3   Space utilisation figures

The following space utilisation figures were presented by Georgeson:

	Gourdie Building Oct 2000	Discovery Centre Building June 2002	Change
Shared Workspaces	4,032 sq ft	26,323 sq ft *	+ 22,291 sq ft
Percentage	4%	30%	
Individual workspace	107,794 sq ft	63,226 sq ft	- 44,568 sq ft
Percentage	96%	70%	
Total AREA	111,826 sq ft	*89,549 sq ft*	*- 22,277 sq ft*
Occupants	486	486	
Density	184 sq ft / person	130 sq ft / person	- 54 sq ft
* FIXED: Conference rooms, Decision Suites, Quiet Booths, Restaurant = 16,301 sq ft FLUID: Breakout, Team spaces, Design Studio = 10,022 sq ft			

5.5.4   Success of the relocation process

It was perceived that the balance of staff involvement and communication was successful: '*The whole process was successful: everybody was engaged, the steering committee was set up, and there was regular communication, both to the team and wider audience. Overall the project was driven in a very logical manner*' [18]

Georgeson was involved in the project 1.5 years before the move, and therefore, there was plenty of time to engage staff and therefore time for change management.

There was, however, some resistance towards the change: 'The relocation was a learning experience for NCR and perhaps, a few people did not see the value of this.'[19]   The resistance of staff was generally perceived as a minor barrier in the project. In the beginning of the project, the staff was

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[18] Ray Robertson (Oct 2003)
[19] Ray Robertson (Oct 2003)

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more concerned of the seating arrangements, than focusing on the process of improving the functions of working.[20] Middle management was also concerned about the new ways of working, especially working in the open plan office. Therefore presentations were organised for managers to help them to understand the benefits of the new ways of working.

It was also perceived that: *'It took a long time to get people engaged, because they were use to the old approach where they weren't asked for their needs. They also didn't directly see the value of their input. But when the time went on they realised that there was a huge benefit in having an input to what environment they were going to be located in.'[21]*

Budget also become as a barrier towards the end of the project. Initially a fitness Centre was planned to be built, but due to lack of money, this could not been built.

The budget was also a barrier in the further staff relocation to the Discovery Centre (After the major move from the Gourdie Factory facilities) following the consolidation of locations. Due to lack of money, the village-concept of Discovery Centre could not be adapted to the top floor of the building. Instead old furniture, and therefore, the old layouts were provided.

5.5.5   Findings from the interviews (Oct 2003)

Additional to the data collected through NCR and Georgeson, interviews with the key people[22] were carried out (Oct 2003) to understand the current state of the workplace processes (after the CbP process was completed). The following feedback was gained through these interviews:

No formal communication between FM and business.

Before the move to the building the steering group (including FM) met weekly, but during the occupation FM met with the steering group, at first every fortnight, but a couple of months later this went up to monthly meetings and finally these meetings faced out when enough was perceived to be done to support businesses day-to-day activities.

As a part of this activity FM made Walk throughs with the Management (mainly with members of the steering group) to make sure the facilities met the expectations. This however also faced out, due to mutual lack of organising this – either Facilities or the business haven't initiated to meet since.

The initially the people who were selected as 'village bobbies' (members of a steering group) were meant to make those tours in the areas allocated for them and make sure it was all clean and tidy and if necessary approach FM with suggestions for improvements. Some of this happened in the beginning to achieve the satisfactory environment, but once this was achieved, the activity stopped.

It was suggested in the interviews, that *'there is a need for a more formal process signed off by the business which should have improved communication at its core'*.

The internal 'spotlight magazine' in which the progress of and comments about of the relocation process was reported was stopped soon after the relocation.

The helpdesk is the only communication method (in addition to informal ad-hoc discussions).

No formal process for office moves: The teams within the R&D activities change regularly and therefore there is a frequent need for restructuring office layouts. Although the intention was that the 'village bobbies' or the management were to initiate and plan the internal moves amongst the teams and carry out minor desk moves themselves, the Facilities Management have been called to make most of the moves.

From the business management point of view it was indicated that it is difficult to co-ordinate the moves between the teams and that there would be a need for somebody to facilitate the moves process in such a way that it was fair to everybody and so that a valid business case for relocations was presented. It was also suggested that the business sees space moves as facilities logistics and

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[20] Georgeson (Oct 2003)
[21] Ray Robertson (Oct 2003)
[22] Designer/consultant, Business Unit Manager, current FM director and FM directo during the relocation   18

not as part of their core business. Perhaps, business should take an ownership of the moves, however support from Facilities Management, as a facilitator, would be greatly appreciated.

Protection of team spaces: It was suggested that the lack of organised office moves had lead some feel that the office moves were sometimes unfair and management had also started to be very protective about the space allocated to their teams.

Involving staff to decision-making:
Since the relocation, there have been no workplace projects, in which staff would have been engaged in such a volume as in the R&D relocation project.

After the major R&D relocation from the Gourdie Factory to the Discovery Centre, some space was left free for further relocation of staff from another NCR site. These people were not involved in the CbP process and did not therefore participate in the change process. Due to lack of funding this part of the Discovery Centre is provided with the old 'three person buckies' as in the previous office facilities in the Gourdie Factory.

It was recognised that it would have been nice to be able to carry out a similar process of involvement in this relocation project as well, but due to lack of money to be invested in this there were clear limitations of choice in layouts and furniture to be provided. Therefore, it was perceived that there was no point in engaging the staff to this project.

Generally the principle and benefits of staff involvement were recognised by the Head of Facilities Management as: '*From people involvement point of view we are happy to involve them in space improvements, but we also want them to get involve from an engineering point of view and very little is done from a satisfaction view.*'

Appropriateness: It was suggested that the majority of staff feel that the current working environment is appropriate for their needs and open plan is preferred rather than separating walls. Some staff would, however, often prefer the old office arrangement, where they had private offices.

On the other hand it was perceived that following the further move of staff (where old kind of environment was provided, as described above), there was a variation of opinions about the different work settings in the Discovery Centre. '*Other people In Discovery Centre complained that the building was suppose to be open plan, and that they did not have an opportunity to use the 'old-kind' of environment used in 3rd floor. Some of the people, who moved to the 3rd floor, complained that they wanted open plan as in the rest of the building.*'

Adaptability: Despite the problems with the internal office moves it was suggested that the office space is generally very adaptable. Some adaptation had already been done, for example HR department is being provided with more privacy by putting up partitioning walls.

Most of the shared spaces are used as intended. However, some of the ad-hoc meeting areas have been taken over for project working. A few meeting cubicles have also been taken over by management, which has been perceived justifiable, due to frequency of meetings and need for privacy. It was suggested that generally this has not seen to be causing any problems amongst the staff.

Flexibility: It was perceived, through the interviews, that the office space was flexible to accommodate different activities: There are plenty of different space settings available, the furniture is easily movable, IT cables are on the fixed platform and some of the rooms can be divided according to different needs.

It was also perceived (by FM) that the Discovery Centre, however it is flexible, requires a lot of FM's resources (people and time) to move things around.

Learnability: It was perceived that people learnt to use the space fairly soon after the relocation. There has been no need to educate people since, because people generally seem to know how to use the space. For new staff there is no formal introduction to how the space is used. This usually happens informally via peers.

Referring to the use of the staff restaurant it was seen that people quickly adopted the idea of having informal meetings in these facilities instead of formal meeting areas. This idea was also quickly spread to the canteen in the Gourdie Factory, which had been refurbished at the same time Discovery Centre was built.

The one thing that people have not learnt perhaps that well is the room booking system, which does not seem to work very well -rooms are booked, but then not used.

Efficiency: Concerning the measurement of improved task completion it was suggested (from business point of view) that there have been too many other changes taken place which means that it is not possible to attribute any improvement in deadlines to the facility change alone. Therefore, it cannot be shown that business performance in the new location has improved.

From the facilities management point of view it was also perceived that the measurement of efficiency is difficult: *'It is very difficult to measure office effectiveness and to demonstrate that certain layouts, such ones in Discovery, has increased the input.'*

However, in the past a Business Unit Manager had recognised that in the Discovery Centre the same job was done with 20% less people. It was perceived, by Facilities Management that *'this could be a reasonable measure but its effectiveness could be questioned'*

Instead the Head of the Facilities Management was keen to measure changes in the manufacturing environment, where the outcome could be easily measured through units produced: *'Would be very interesting see what impact facilities, such as tea and coffee bar, more comfortable chairs and higher quality flooring would have on increased output. In these facilities, we could measure improvement in more quantitative ways, for example, if the yield is the same but production of units increases. This would be more effective measure, where as efficiency is more difficult to measure'*

Case study: Old Mill, Turku, Finland

April 2004

CIB Taskgroup 51

USABILITY OF WORKPLACES

Case study: Old Mill
Final Report

19th –20th April 2004

VTT
Turku Polytechnic

SUMMARY

The third European workshop of the CIB51 Task group – 'Usability of Workplaces', is arranged in Finland. The associated case study focuses on the elements of usability in a refurbished working environment of Old Mill Business Park. The Old Mill is located in Turku Science Park area and offers services as well as functional and interesting premises with an atmosphere of an old factory for ICT companies. The floor space is 15.100 sqm in four floors.

The case-report includes the illustration of the Old Mill in the context of creating a brand. The brand, in fundamental level, includes usability and it offers a way to describe the quality of the building. The aim of the case study has been to analyse the existing status of usability. The analysis is undertaken in two phases – 'Diagnose' and 'Discussion' - and the third phase – 'Dialogue' - is being proposed. The diagnosis phase consists of a **workplace survey** in the form of a questionnaire. The diagnosis indicated the areas of low usability. After this, the **'usability walk through'** was organised in order to get more information about the low usability as well as discuss about the ways to improve it. Third phase is under development – the intention is to set the information got collected through diagnosis and discussion to the context of future requirements of the building. The tool for this dialogue phase is software Ecoprop.

The status of usability Old Mill is quite high, but some areas of improvement have been identified. The aims include:
- customer orientation in the car parking area (serviceability),
- 'smarter' (multiple) use of the entrance hall - focus on different options and communication of these to the users in order to encourage them to use this space more efficiently (learnability)
- efficient use of the restaurant lunch buffet by improving the logic of the layout (functionality)
- Better guidance of the ways the meeting rooms are used. amount of information for the use of meeting rooms (functionality)

The learning points of the case study are
- the intangible character of brand is a relevant way to approach usability
- the dissatisfaction management is a good starting point to investigate where the usability can be increased
- the user experience has an emotional background: this fact of subject is important to keep in mind during the ways to gather information
- the results of the usability surveys has to be handle as a part of process, not only as frozen facts and figures

The case study focused mainly on the common areas in the Old Mill. The individual workstations were not considered in this phase. The future challenges include the use of EcoProp to create the usability profile in the shared facilities of Old Mill , but also in the occupying organisations -with their own brand and user requirements- within the Old Mill and the Science park.

Suvi Nenonen   **Kari Nissinen**   **Janne Porkka**   **Riikka Huovala**

1 OPERATIONAL ENVIRONMENT OF OLD MILL - TURKU SCIENCE PARK AND ITS BRAND
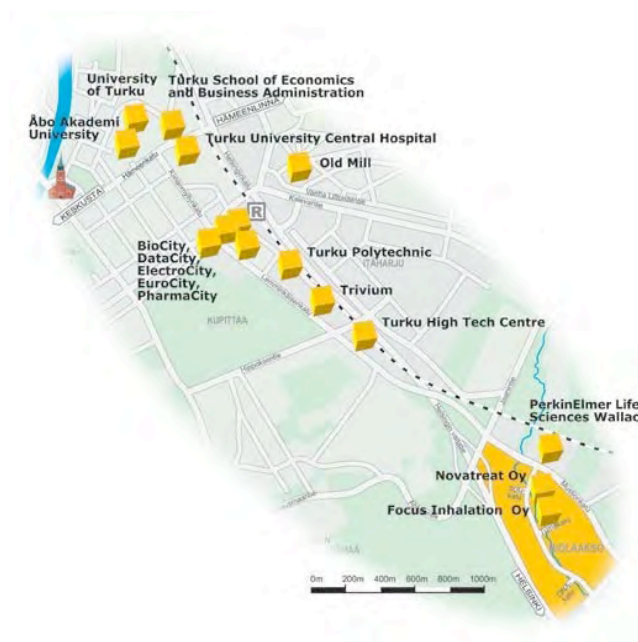
Turku Science Park is the core of the innovative environment in Southwest Finland. The case study is made in Old Mill, which is located to the area of growing science park. The strengths of the region's trade and industry, universities and institutes of higher learning as well as infrastructure and human resources create the infrastructure of the science park The result is a truly innovative and interactive operational environment, which serves as an efficient basis for high-tech growth. The brand of Turku Science park is attractive.

Brand itself is an old innovation and they have been used mainly for marketing the tangible products. (Klein, 2000) The use of them i.e. in the service sector and in the real estate branch is relatively new. VTT has created a comparison method for different brands within a research about real estate brands. The research group benchmarked many real estates and real estate companies including some science parks from the viewpoint of brand (Riihimäki et al, 2003). They found four major elements.

1. Location
2. Functionality (includes usability)
3. Services
4. Associations and Image.

These four elements can be described as the basics of the real estate brand. These are the main points to concentrate on when evaluating any real estate, building, facility or premises (figure 1).
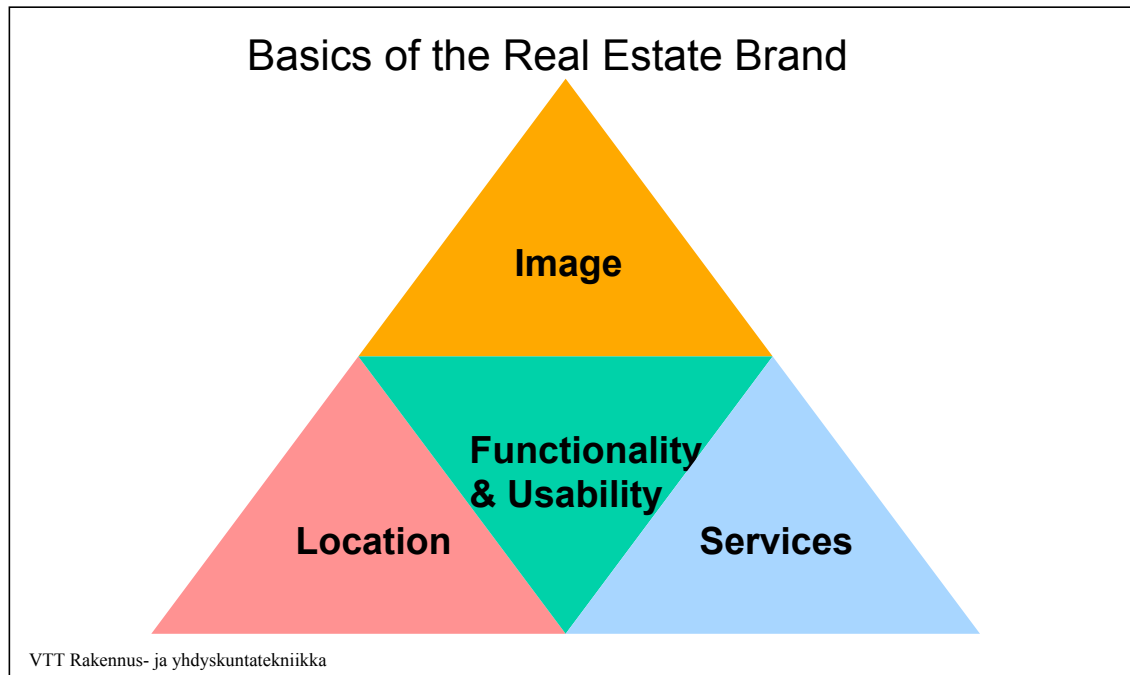
Figure 1. The basics of the real estate brand. Source: VTT Building and Transport.

What is the Turku Science Park brand like? How does it show up? What kind of operational environment does the Turku Science Park offer?

According to the comparison method Turku Science Park brand is anlaysed. In coparison with several science park brands the following conclusions can be made (*figure 2*):
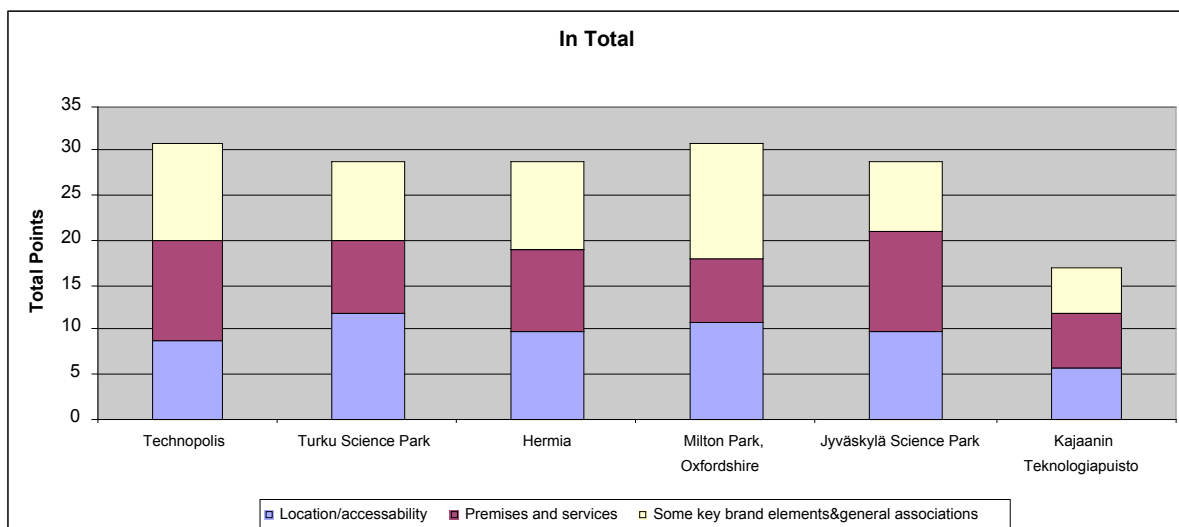

Figure 2. Science Park Brand benchmark. Total points. Systematics: VTT Building and Transport.

In brief the Old Mill is located to the Science Park with following characteristics.

- Location of Turku Science Park seems to be excellent.
- Premises and services seem to be on average level.
- Turku Science Park does not utilize every key brand element fully. However, the general associations and impressions are positive.
- In total Turku Science Park brand gets some points less than Technopolis, Espoo but stays on the same level than Hermia, Tampere and Jyväskylä Science Park.
- More detailed description of the benchmark is shown in *Appendix 1*.

In this case the results are highly subjective, but on the other hand the brand can be evaluated in this way. Brand is more a mindset, intangible concept than the pure fact, This comparison is made using the public image Turku Science park is giving i.e. in www-pages. The comparison includes only some of the key factors that usually effects on the brand. Every factor is valuated from 1 to 4 where 4 mean the best level. When calculating the total points every single factor has the same weight.

2. THE OLD MILL

The Old Mill is located in the Kupittaa area of Turku close to three universities and the polytechnic. The building itself is an old ceramic factory renovated for the use of ICT-companies. Turku wanted to raise its profile as an important center for ICT-business. Consequently, the decision was taken to renovate the old factory as a modern center for ICT-companies The interior of the building has been left exposed in the renovation giving the estate its unique feeling combining modern technology with the building's historical features.

The Old Mill includes a number of additional services alongside its functional and interesting office space. The building is equipped with latest data network connections to provide the best setting possible for the ICT-companies in the estate. Tenants also have access to a number of meeting rooms as well as an auditorium for their use. Sodexho manages a restaurant in the building providing the perfect setting for business as well as private functions. Petrasol Business Centre oversees the running of the Old Mill's reception area, switchboard, as well as the building's Intranet.

The building of the Old Mill presents the imago and brand in a similar way as the name , slogans or logo. The Old Mill has its own profile and identity which differs from the surroundings and manages to provide something unique for the companies. The slogans in www-pages **From a ceramic factory to a technology center – a glance into Old Mill's history** and **New technology in an old factory** make the brand exciting, unique, valuing tradition

3 SPACE UTILISATION IN THE OLD MILL

It is well known that the costs of office environment constitute only a small part of the total costs of a typical office work organization. However, the importance of working environment quality is essential for any organization due to several reasons, for instance:

- High quality working environment enables the office workers – the most important resource of the know-how organization - to do their best every working day and every working hour.
- The business challenge of today is simple: Do more, faster and better, with less.
- For any company a high quality working environment is an important advantage when competing for the best workers.

In Old Mill 84% of total floor space is leased for the tenants. The share of actual office space (including support space, internal corridors etc.) is 69%. This means that there is about 23 m2 of office space per worker in Old Mill (table 1).

	m2	share	workers	m2/worker
Office space	10 478	69 %	453	23,1
Printing house	491	3 %	6	81,8
Laboratories	525	3 %	6	87,5
Photo studio	247	2 %	2	123,5
Restaurant	374	2 %	8	46,8
Film studio	585	4 %	5	117,0
Leased total	**12 700**	**84 %**	**480**	**26,5**
Auditorium (joint use)	180	1 %		
Classroom (joint use)	40	0 %		
Meeting rooms (joint use)	170	1 %		
Other space (joint use)	2010	13 %		
Total	**15 100**	**100 %**		**31,5**

Table 1. Space distribution and space per worker in Old Mill.

According to the research (Nissinen, 2003) the space use of Finnish offices can be described spacious. The average space utilization in Finnish offices is about 25 m2/worker (excluding the joint use space). The office space utilization in Old Mill is below the national average but it is still quite high when comparing to the international values (figure3).

Space Utilisation Per Worker

| Country	m2/worker
Germany (5 cities)	22,5
USA (13 cities)	21,7
Holland (3 cities)	21,0
Canada (5 cities)	20,8
Australia (6 cities)	19,7
Japan (Tokyo)	11,6
England (6 cities)	11,2
China (8 cities)	10,8
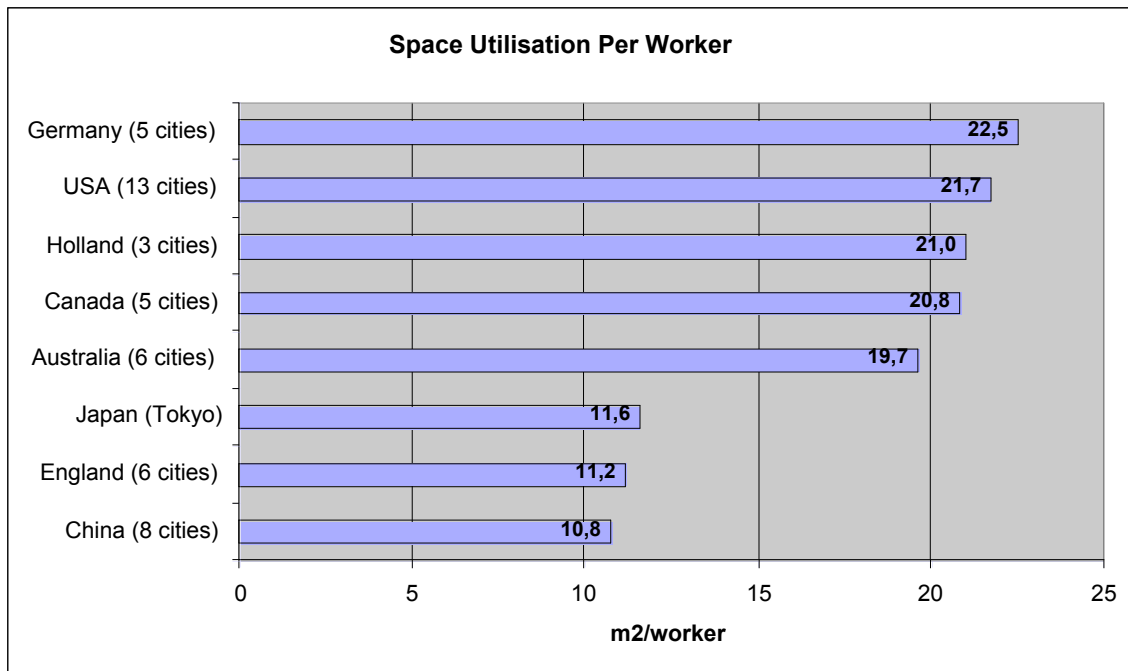
m2/worker

Figure 4. International office space utilization comparison. Net usable area that is used by the organization divided by the number of workers. Big cities, Central Business District Locations. Source: DTZ Debenham Tie Leung International Property Advisors Space Utilization Standard.

4 USABILITY CASE STUDY

The focus in the case study was to find out how to gather information about the status of usability. The source of information for usability is in users daily experiences: they feel the satisfaction, the effectiveness and efficiency of their work environment.

The case study used three ways to gather data
  1. the questionnaire
  2. the usability walk through
  3. the application of Ecoprop software

The questionnaire was a telephone interview with yes/no questions about the Old Mill environment. The basic structure of questionnaire was based on the classification of real estate made by Brand(1993) and applied by Blackstat (2001) in figure 4.
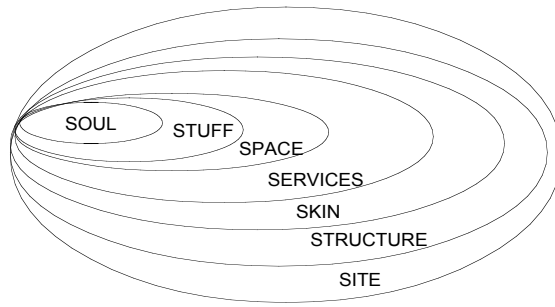
Figure 4 The seven s-model by Brand and Blakstadt

Brand´s model included six s and Blakstadt added the seventh s, soul. The soul in this case study of usability presents the main actor, the user. The source of data is user´s experience.

The other classification used as a framework for questionnaire was the definition of usability according to ISO 13407:1999: Usability is the "effectiveness, efficiency and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment."

The questions were not only asking if people were satisfied for different components of work environment but also if there were enough of them and if they were easy and efficient to use.

In summary the results can be presented in a table 2.

	Low usability	High usability
SITE	Lack of parking places – specially for customers	Nice imago
STRUCTURE	Not enough signs – specially for customers	Secure infrastructure and structure as such
SKIN		Security services are good
SERVICES	The slow catering services – specially lunch time	The helpdesk services are high quality and functional
SPACE	The emptiness and of entrance hall	The meeting rooms are nice, comfortable.
STUFF	The use of lightning and air-conditioning is difficult	The possibilities for ICT work are good.

Table 2 High and low usability according to user´s experiences in the Old Mill

4.2 Usability walkthrough

In walk through evaluation, the end users, on various levels, evaluate the focus area diagnosed as high or low usability in the diagnosis -phase. The technique is suggested as a tool to evaluate the workplaces, identify the gaps between the original design concepts and the current use, and to provide a platform for different parties to communicate.

The balance of the participants is important. The team for usability walk through included
- the architect of the present structure in Old Mill
- the service provider of help desk services
- the service provider of catering services
- the facility manager
- the end user
- the usability researchers (3)

The route for usability walkthrough was identified by using the former data from the diagnosis phase. The results were described briefly and the participants have had the chance to prepare. They got some guiding questions beforehand.

Participants were encouraged to reflect their views on the facilities and open-ended questions asked to prompt. Topics were recorded. During the walk through, the participants observed the facilities and began to discuss the causes and effects of use of spaces. Participants speculated on four milestones:
- The entrance space
- The restaurant
- The meeting room
- The parking area

VIEW	FACT	RECOMMENDATION AND FINDINGS
The entrance space	The entrance space is large and the reception/ help desk is located on the other end of it. As the desk is relatively distant from the entrance itself, it is not immediately noticeable when you enter the building. This sometimes causes confusion for visitors. *"We often need to catch visitors attention, because they don't notice us"* - reception	Make the help desk service visible. Hospitality (of reception staff) increases usability – service is an intangible attractor.
	It is assumed that visitors approach the help-desk/reception first in order to provide security (limited access to offices). Therefore there is a limited amount of signs and guidance.	People should be encouraged to **learn** to use the help desk. Host should inform the visitor about norms.
	The "lobby-area" is in low use *"People are not familiar with using such a open entrance spaces"* - architect People are not utilising this space for other purposes (multi-use), such as meeting, displaying products, events etc. *"People don't want to be seen to sit in a lobby as this means you are lazy"*- FM "	To provide information about multiuse possibilities The attractors: vending machines and touchdown desks The furniture solution - Encourage for communication and interaction (greeting and informal meeting) - Should the space be divided to provide more privacy? - Focal point to the entrance (

	The design of the space creates a "wow"-effect. *"I chose to work here because I was impressed with the design of the building"* - user	A lively and dynamic atmosphere should be created to sustain the positive 'wow' impression. (from the first impression to the total experience – "wow, here is a pulse"-effect) Maintaining the 'wow' effect throughout the building -
The restaurant	*"The layout of the lunch buffet is illogical - wrong way round"* – service provider	Use the towards the clockwise Arrangements Change the location of the cashier
	The lack of information about "traffic" rules	Signs
	Limited use of two meeting rooms after the restaurant closing time	Information Room booking arrangements
	On-peak time queuing is time consuming and frustrating "I sometimes turn back when I see the queue and come back later" - user	Encouraging people to have their lunch on off-peak times – rewards (free coffee and dessert etc.)
The meeting room	The light and ventilation switches are illogical: Red light indicates that the ventilation is switched on – confusing message (red = danger) To control the level of light you need to press rather than turn the switch – Delay in the change of the level of light - difficult to achieve desired level. *"It is embarrassing when the lights turn off in the middle of a important customer meeting"* - user	Guidance for, and information about, efficient use.
	As a consequence after combining two smaller meeting rooms, the light and ventilation switches are not next to the new main door (having to find the switches in the dark)	Investigate new solutions (Remote control etc.)
	It is difficult to serve food and beverages in the two small meeting rooms.	Consideration of furniture solutions
	The need for larger meeting spaces has increased – more training sessions	Use of entrance space?
	ICT system and security – the same phone line for two rooms. *"We need an absolute confidentiality also during the tele-meetings"* - user	Under assessment.

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The Parking area	Not enough parking space for customers. *"I sometimes have to go and re-park our customers' cars because the allowed parking time is only 2 hours – less than most of the meetings. "* – user	Help desk service can be developed

Table 3 Usability walkthrough

The status of usability Old Mill is quite high, but some areas of improvement have been identified. The aims include:
- Customer orientation in the car parking area (serviceability),
- 'Smarter' (multiple) use of the entrance hall - focus on different options and communication of these to the users in order to encourage them to use this space more efficiently (learnability)
- Efficient use of the restaurant lunch buffet by improving the logic of the layout (functionality)
- Better guidance of the ways the meeting rooms are used. Amount of information for the use of meeting rooms (functionality)

4.3 Ecoprop

EcoProP is a software tool for the systematic management of building project requirements. The EcoProP software helps to fulfil customer requirements and expectations by describing the properties of the final product using a hierarchy of performance requirements and different performance 'levels'. The technical solutions can then be designed based on the specified performance requirements. EcoProP can also estimate life-cycle costs associated with different scenarios, based on the environmental 'costs' which result from the construction and operation of the building. EcoProP has been used in various projects including office buildings, schools, nurseries, residential developments and shopping centres. The intention is to use the software in the usability case study in two ways:
- to develop the hierarchy of performance requirements for usability and different performance levels for it in order to develop a usability profile
- to develop the dialogue between hard data from the building and soft data from the user in order to combine two perspectives in an effective way.

Flexible content – wide applicability

EcoProP comprises a database of performance requirements and an easy-to-use interface to the database. There are a number of requirement definition sets, which correspond to the possible requirements of different building project types. The application has been primarily designed for the building and construction domain but it can also be used also in other domains by adding new requirement definition sets. The user can select from one to five pre-set performance levels for each requirement and then add their own comments. EcoProP can be used to manage performance requirements for new building projects, and can also be used to some extent for evaluating the performance levels of existing buildings.

Functionality

Based on the specified performance requirements, the user can print out a project brief in HTML or Word format. The reports can be customized for relevant stakeholders. For example, only part of the requirements is relevant for the electrical engineer so there is an option to print out only the relevant requirements separately. It is possible to also have a report only on certain performance properties (such as adaptability) or a thematic re-port such as 'health related' requirements.

The application provides estimates the life cycle costs of the building. This analysis is based on the cost factors associated with different performance levels and the baseline information of the project. The user can use NPV and Annuity methods in the calculation and the discount rate and time-frame can be changed. Additionally the environmental 'costs' due to the operational energy consumption can be estimated.

The first step for setting requirements in EcoProP is to start a new project. The user then selects the right requirement definition set (e.g. office building or apartment building) and then adds the baseline information on the project, e.g. investment cost, operational cost, energy unit cost, size of the building etc. It is also possible to add different scenarios for each project. The user then selects the appropriate performance level for each relevant requirement. The requirements are listed in the left hand side of the window. The information on the requirement can be found on the right hand side: name, description, validation, and place for own comments and one to five pre-set levels.

A requirement profile can then be created based on the average of the normalised performance levels for each requirement. The user can compare different scenarios and get a quick understanding of the project performance requirement levels.
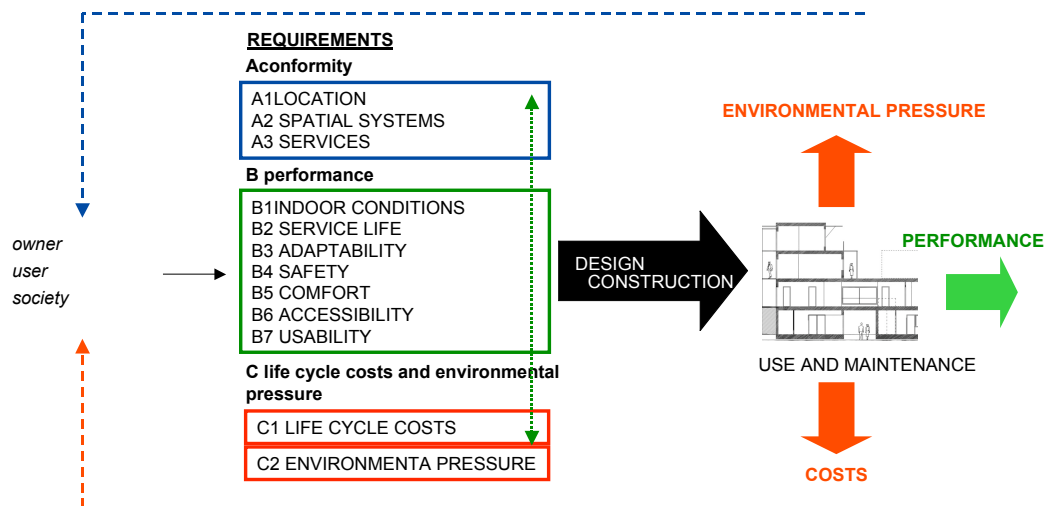
Figure 5 Ecoprop in brief

4. THEORETICAL CONSIDERATIONS

The intangible nature of brand includes the usability. The five star usability can be developed as a part of the brand building process. The brand can also used as a framework for classifying the usability – the brand is a concept, a mindset, which have tangible artefacts like logo, slogans, buildings etc. The usability has intangible elements as well: not only satisfaction but also the productivity and efficiency aspects.

To structure the complex variety of subjective expressions of experiences the model of evaluation space of usablity attributes is interesting framework. Keinonen (1998, 159-161) writes: "The different domains in the evaluation space have a character of their own. In the personal domain the influence of feelings is considerable. In the task corner the attributes related directly to the task for which the product is meant are emphasised. In the product corner the qualities of the representation are in focus." The domains are presented in the figure.

Figure 6 Evaluation space of usability attributes

Accordig to Keinänen (1998, 159-161) the personal domain is characterised by affective criteria (AFF), the product domain by presentation (PRE), and the task domain by functionality (FNC). The relationship between the personal domain and task domain is described by usefulness (USE), between the personal domain and product domain by ease-of-use (EoU), and between the product domain and personal domain by logic (LOG). This classification can be useful to work further with the concept of functionality as a close concept for usability. During the case studies in work group CIB TG51 the discussion around the concepts of usability and functionality have been relevant. In notes from England following structure was presented with the remark that usability need to include all levels.
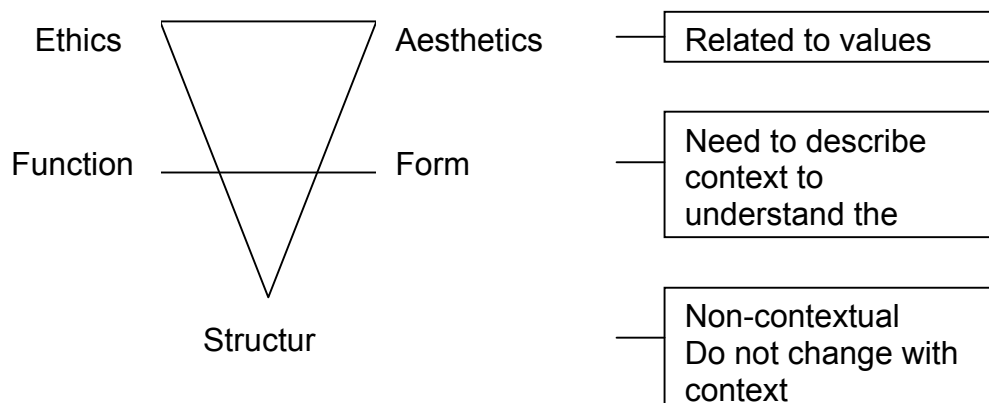
Figure 8 Different levels and dimensions

The combination of these two triangles might help the further work within the taskgroup to position usability and functionality in a clearer way.

**PERSONAL DOMAIN
- USER**

ETHICS   **AESTHETICS**

**TASK DOMAIN**   **PRODUCT DOMAIN**
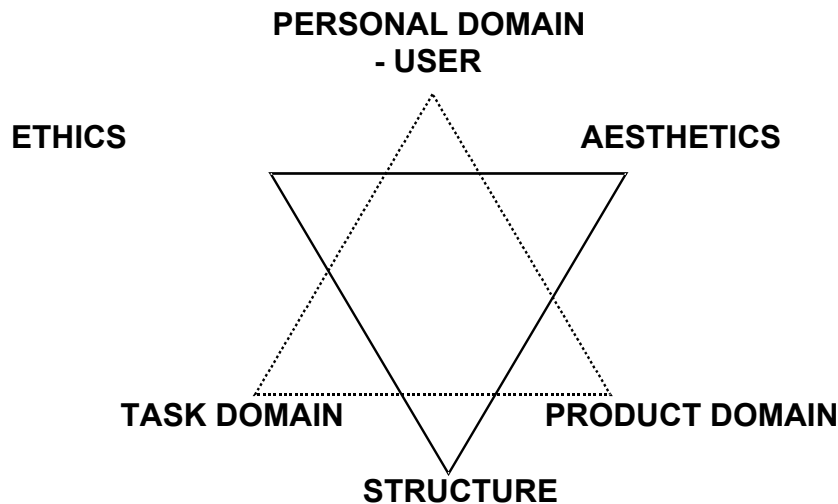
STRUCTURE

Figure 8. User - Structure

The usability discussion can be user-led or structure-led. Both approaches are relevant. The user with emotions, senses and needs is the main acto. The structure, functions and products are the cornerstones for another approach which has its significance in

6.CONCLUSIONS

The third workshop is meant to add the understanding of the user experience as a starting point to develop usability. The main issue is not to measure because of the results but to investigate in order to improve the usability. The way to express the process used for getting the information can be illustrated in following way (figure 9)

DIAGNOSIS (questionnaire)

DISCUSSION
(usability walk through)

DIALOGUE
(EcoProp)
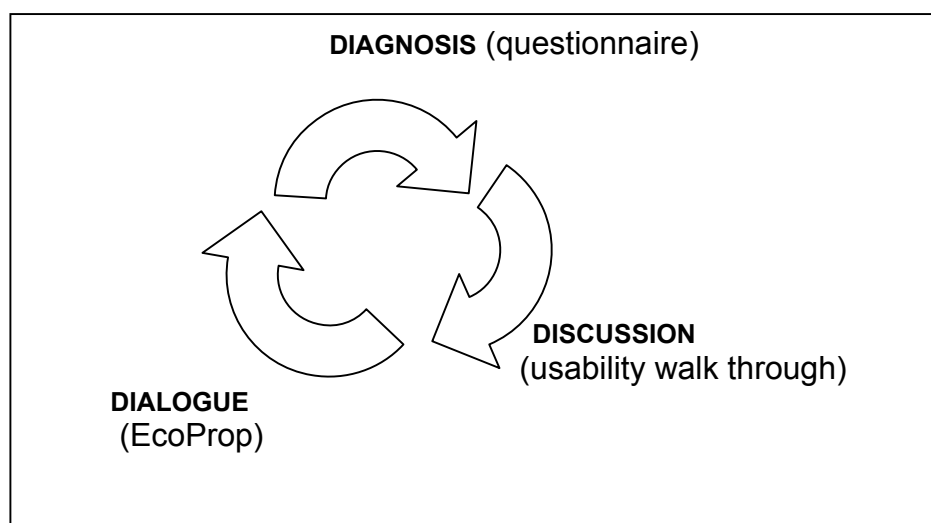
Figure 9   3DI -model

I The diagnosis phase investigate the weakest points in usability and the outcome of this phase is a general picture of the status of usability according the user's experience. The questionnaire can be used as a method. The result is quantitative and informative.

II The discussion phase provides closer and in-depth investigation offering also the possibility to gather different point of views to the defined target area with low usability. The usability walk through can be used as a method. The result is a qualitative data based on group interview and observations.

III The dialogue phase is a interaction between the technical data about the building and the user experience data about the usability – the outcome of the dialogue is a usability profile, an illustration to be used in brand building as well as on going improving of the high-performance in a real estate.

The 3 DI-analyse models is a way to find solutions to the usability of workplaces. The intention is to develop usability of workplaces in a way, which provides the concentrations to essential issues in an effective way. The question which needs to be worked further in 3 DI-analyse model is if the usability improvement process can be started from whatever DI.

To summarise the learning points of the case study following list is relevant:
-    The intangible character of brand is a relevant way to approach usability
-    The dissatisfaction management is a good starting point to investigate where the usability can be increased
-    The user experience has a emotional background: this fact of subject is important to keep in mind during the ways to gather information
-    The results of the usability surveys has to be handled as a part of process, not only as frozen facts and figures
-    The product domain, the task domain and the personal domain are important to recognise as well as the perspective of the user or the structure in usability discussions

The case study concentrated purely to the common areas in the Old Mill. The individual workstation was left out in this phase. The future challenges are in developing the use of EcoProp for creating the usability profile in Old Mill as such but also in organisations with their own brand, with their own user requirements within the Old Mill and the Science park.

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APPENDIX 1: Science Park Brand Benchmark

1   Location/accessability

		Technopolis	Turku Science Park	Hermia	Milton Park, Oxforshire	Jyväskylä Science Park	Kajaanin Teknologiapuisto
1.1	City/district	Oulu: dynamic, significantly growing district centre	City with great history, growing district centre	Significantly growing district centre	Oxforshire, Thames Valley ("Sounds very good")	Growing district centre	Not-growing district centre
	* points	3	3	3	3	2	1
1.2	Premises: How far away from the city centre?	Most of the premises about 6 km away from the centre of Oulu	Most of the premises about 2-3 km away from the centre of Turku	Premises about 10 km away from the centre of Tampere	About 12 miles from Oxford	Most of the premises comfortably at the centre of Jyväskylä	Premises standing less than 5 km away from the centre of Kajaani
	* points	2	3	2	1	3	2
1.3	Premises: How far away from the international airpot ?	n. 600 km	n. 200 km	n. 200 km	n. 45 miles	n. 300 km	n. 600 km
	* points	1	2	2	3	2	1
1.4	The availability of well-educatied workforce, interaction with educational institutions	University next door, Polytechnics at the City Centre	2 Universities, School of Economics and Polytechnics inside the same "trade mark"	Technical University next door, University and Polytechnics at the same city	World-famous academic society nearby	University and Polytechnics at the same city	Polytechnics and some "away"- units of Oulu University at the same city
	* points	3	4	3	4	3	2
	* Total points	9	12	10	11	10	6

Case study: Technocentre Renault in Guyancourt:
The Building La Ruche, France

September 2004

CIB Taskgroup 51

USABILITY OF WORKPLACES

Case study: Technocentre Renault in Guyancourt: The Building La Ruche

Draft report

6th September 2004

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1   SUMMARY

This is the fourth workshop of the CIB51 – Usability of Workplaces. The object is the vehicle design and development centre of Renault - Technocentre Renault. The study focuses on the occupation of one specific building – the Ruche – where more than 4000 people work in product and process engineering.

The report is based on interviews with management and staff from the operational division of Vehicle Engineering Development and interviews with actors in charge of facilities management, building design process and workplace strategies.

The management considered the implementation and use of the Technocentre as an essential part of its change strategy in vehicle design and development. This led to a very ambitious approach both in the architectural and landscape treatment of the site and in the way the building / facilities management has to support ongoing change by which the organization seeks to adapt and improve its processes.

The case study examines the way the organization occupies and manages the Ruche. Then it questions the perceptions of benefits within the organization based on the experience of use. It turns out that the learning process – knowledge about the building and its possible uses – is an important aspect of the perceptions, of the way the organization actually use the building and of the way it envision change.

The draft report presented during the workshop on the 6th September is intended to give a first idea of the case and the analysis. The complete and final version will be developed after the discussions of the workshop.

The Avancée

The Ruche

The Proto

Figure 1 : A sign with the site map

2

CONTENT

2   Le Renault Technocentre

The Renault Technocentre

The Renault Technocentre (TCR), located in Guyancourt (around 25 km southwest of Paris), groups together the company divisions responsible for the design, development and the definition of vehicle production means[1]. A first phase of this vast building complex was completed at the end of 1998. It permitted the arrival of 8,500 persons. 2,000 additional persons began working there in 2002. The site now has 11,500 occupants.

The TCR is considered to be "the architectural translation of Renault's new technical organisation in the field of vehicle research & development"[2]. Its designated objective is to be "a major instrument at the service of profitable growth" by bringing together, on a single site, all those concerned with vehicle design. Previously, these persons were spread over several sites in western Paris, particularly those in Boulogne-Billancourt and Rueil-Malmaison. With over 1,000 non-Renault employees, being equipment manufacturer and supplier staff, the site also backs the permanent presence of partners and subcontractors.

With this dual organisational and spatial change, the company aims to (1) reduce the car development period to 36 months as from 2000 and then subsequently to 24 months, (2) improve the quality of the work carried out as from the design phase and (3) reduce the development costs for each new car by 30%.

Figure 2: View of the TCR

2.1   The context for the decision to build the TCR

The kick-off for the construction of the TCR was the purchase of the site in 1990. The project for the development of a technical centre and the choice of building on a new site were developed through a complex process of studies and events that had begun in the 1970s. Among the new directions that the company adopted in this process, two were

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[1] Only the Mechanical Division (mechanical organs, engines and gearboxes) is located on a different site.
[2] Renault press release dated 26 May 1998 : *The Technocentre : a decisive asset for Renault's future.*

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particularly important in making the decision to launch the TCR: they concern the way in which the company envisages vehicle design and its location in the Paris region.

For many years, the company had operated with a high level of separation between "Studies", responsible for car design, and "Methods", responsible for technical finalisation and manufacturing tools. The general management was responsible for coordination. The limits to this type of organisation became clear with the diversification of ranges and the acceleration of their rate of renewal during the 1970s. A first stage in the adoption of new methods took place with the creation of "project leaders" in the design phase, and then by the creation of work groups bringing together engineers and technicians from the Studies, Methods and Manufacturing divisions to work together on specific problems.

A decisive stage was reached in 1988 when the company decided to reform its project management methods. A "project team" was created for each development programme. This was maintained throughout the entire life cycle of the vehicle. Placed under the responsibility of a project manager, it brought together all trades (*Métiers*) involved in the development process. As a result, running a project was no longer based on sequential stages but rather on the simultaneous participation of functions in the process. Those involved in the project were placed together on a "project platform".

During this period, the company also decided to group together the Study and Methods divisions on the same site. Two scenarios were envisaged: one was to locate them on the existing historic Boulogne-Billancourt site, the other being to purchase a new site. The Boulogne-Billancourt site had already been the subject of several restructuring studies. These had essentially been carried out within the context of production delocalisation. The issue of what to do with the freed surfaces had always been confronted with a great many socio-political constraints. The company finally decided to separate the issue of financing the TCR from that of the enhancement and potential sale of the site[3]. Having gotten rid of the constraint of having to satisfy the need to enhance a historic urban site, the project for the TCR was more and more considered as a tool able to accompany the company's development strategy.

2.2   The design process and the involved actors

(to be developed)
Programming

Architectural design and implementation

2.3   The site

2.3.1   Choosing the site

A large number of criteria played a role in the choice of the site. Its size had to meet the need for a very large buildable surface area. There were very few sites in the Paris region able to meet the estimated need of 170 to 200 hectares, especially given that the physical quality and the social image of the environment were also considered as being priorities. Another criteria was the site access, especially with regards to other Renault sites in the region. The issue of housing was also taken into consideration. A survey was carried out with the personnel to understand where the staff lived and where they would prefer to live. Apart from confirming the attraction of the western Paris region, the survey also underlined the value of incorporating the housing stock capacity in the area where the TCR was to be located as an additional criterion.

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[3] The sale of Ile Seguin and the Trapèze represent an enormous transaction because of the size of the sites and land value linked to its location next to Paris.

2.3.2 The site plan and the location of the buildings

The financing of the TCR was placed in the hands of a real estate company from which Renault rented the site, with the possibility of subsequently buying the buildings.

The site covers 148 hectares. The total surface area of the buildings (net plan area) is now 412,000 m². The site's buildable capacity is 750,000 m².

The site plan dictating the site layout distributes the buildings along an octagonal grid. The three main buildings, Avancée, Ruche and Proto, are built along the same axis. Their succession corresponds to the sequences of the main vehicle design phases.
The upstream design phases (industrial design, advanced research on the cars of the future) take place in the Avancée building. This building also contains the reception area. Product and process studies take place in the Ruche. Prototypes are developed in the Proto. Equipped with a small assembly line, this building is also occupied by the teams responsible for vehicle manufacturing studies.
A pedestrian walkway is laid out along this building axis. It crosses through the ground floor of the Avancée and the Ruche and continues outside around the side of the Proto, along with a green belt of plantes.

Figure 3: The site plan

The other buildings are set out around these three poles: Labos (materials research laboratories), Diapason (quality), Logistics, Transfert (electricity supply transformer), Déchets (waste treatment), hot water production, etc., Techno-service (maintenance of cars belonging to the personnel and the service fleet), Restaurant and Comité d'Entreprise (works council).
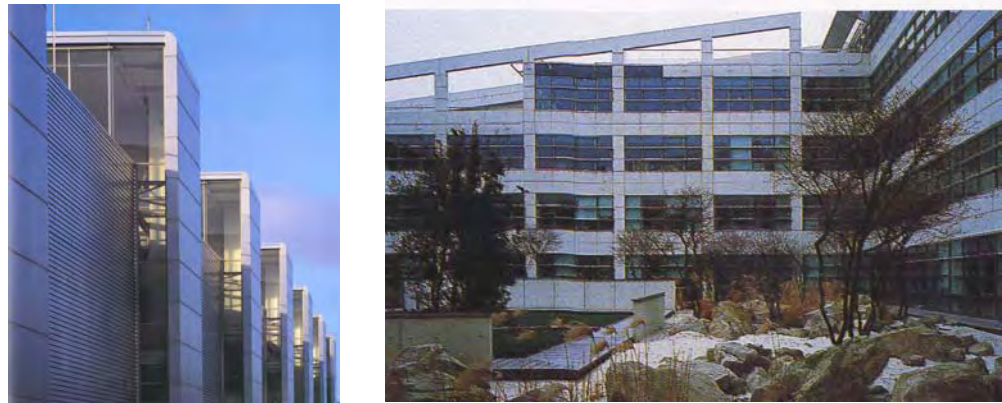
Figure 4: Façade of the Proto, the Avancée,

2.3.3 The architectural and landscaping treatment

Specifications: the proximity of historical sites, such as Versailles, and a protected natural environment (regional nature park).
There was a desire to incorporate the site into this environment by providing a high level of architectural quality and an adapted landscaping treatment.
The landscaping treatment also formed part of the project, as can be seen through the desire to ensure that the completion of the first phase included its attendant landscaped outdoor spaces.

Figure 5: Gallery in the Ruche, footbridge between the Avancée and the Ruche

3 The Ruche

The Ruche [hive], the heart of the TCR, brings together project teams and the expert vehicle engineering trades. Over 4,000 people share a 142,000 m² surface area. The offices are grouped together in H- and T-shaped buildings, four and three storeys high respectively. These buildings are interconnected by cores (vertical circulation zones). They are built over a base containing the modelling workshops where parts and sub-assemblies take form and are tested. The Ruche contains nine patios, including three central patios, which are covered by glazed roofs to form a gallery providing an area where exchanges can take place between those working there. At the ground level they contain restaurants, a bank, information areas and a hairdressing salon.

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Figure 6: The Ruche

3.1 Upper floor layouts

The upper floors, crisscrossed by horizontal and vertical circulation zones, are designed to be modular. The 18 m deep floor levels are laid out as open-plan spaces, including the areas attributed to project and trade managers. The company has established a standard of 9 m² per work station and the ratio of large offices has been set at 6% per division and per building. The work stations are often grouped into twos or fours and are equipped with a meeting table. A large number of meeting rooms are also provided on each floor level.
In terms of global occupation, the aim is to have a 93 % occupancy rate of the work stations.
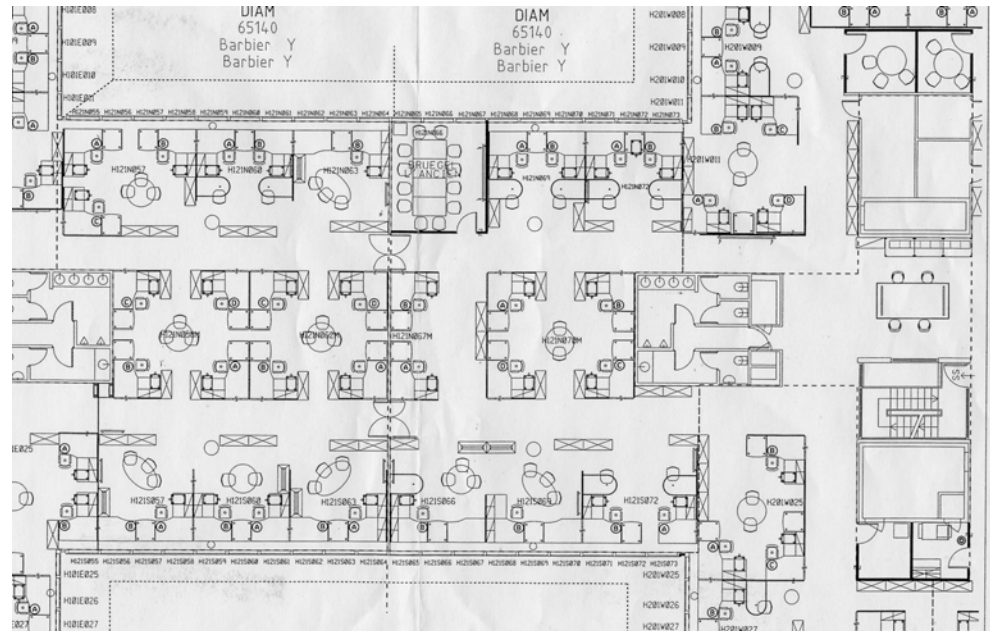
Figure 7: Part of the layout of the Ruche
3.2 The occupation of the building

The site management and the various operational divisions consider that the logic of convergence guiding the management of projects should be reflected in the way that the building is occupied. This logic is applied to both work flow on the site, where a separation is distinguished between upstream activities (in the Avancée) and downstream activities (in the Ruche and the building where manufacturing processes are studied), and between the trades participating in the projects (Ruche occupants). The geographical proximity between

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those involved in the project is therefore an important objective in the positioning of work stations and the attribution of surface areas in the Ruche.

3.3   The principles underlying a new functional masterplan

This level of proximity has in no way become obsolete with the development of information and communication technologies. On the contrary, it has had a considerable impact on the new functional master plan developed in 2002 between the site management, the operational divisions and the strategy and business location division. The implementation of this master plan began in 2003 in the Ruche. It modified the occupation mode used during the first years that the building was in operation when all the floor areas had been attributed to the project teams (for the operational management, the geographical proximity includes both a functional and a social dimension).

The challenge of this functional master plan was to adapt the way that the Ruche was occupied to the organisational changes developed by the management. The change consisted in altering the equilibrium of the organisational structure between the trade section and the project section. Following years of placing emphasis on this latter, organisational requirements revealed the need for a better capitalisation of know-how and its transmission between projects. The trades, which had previously provided a structure that was transversal to the projects, become in the new structure divisions in their own right.
The trade divisions bring together the divisions responsible for projects and the "support" trade divisions.

The new master plan specifies a project layout logic based on the breakdown into sub-assemblies that the project teams had already developed for the cars themselves: the 1st floor is used for the development of the underframe and the engine compartment, the 2nd floor for the driver's compartment, and the 3rd floor for the passenger compartment. The management of each project is located on the 4th floor. As a result, the work stations used by staff contributing to a same project are therefore superimposed over one another, making them easily accessible through the vertical circulation zones. Similarly, staff working on different projects but developing parts for a same type of sub-assembly are grouped together on the same floor level. The building has a capacity to simultaneously house two projects (or a project in growth stage, another in en-route phase, and a third in end phase). The surface areas attributed to projects are located in the centre of the floor levels.
The trades occupy the surface areas around the zones attributed to the projects. Depending on their specific know-how, these divisions are placed close by the teams that they are assisting. Five trade divisions are directly involved in the projects, with the remaining trade divisions being considered as "support" divisions. The management of these divisions are located on the 4th floor beside the project directors.
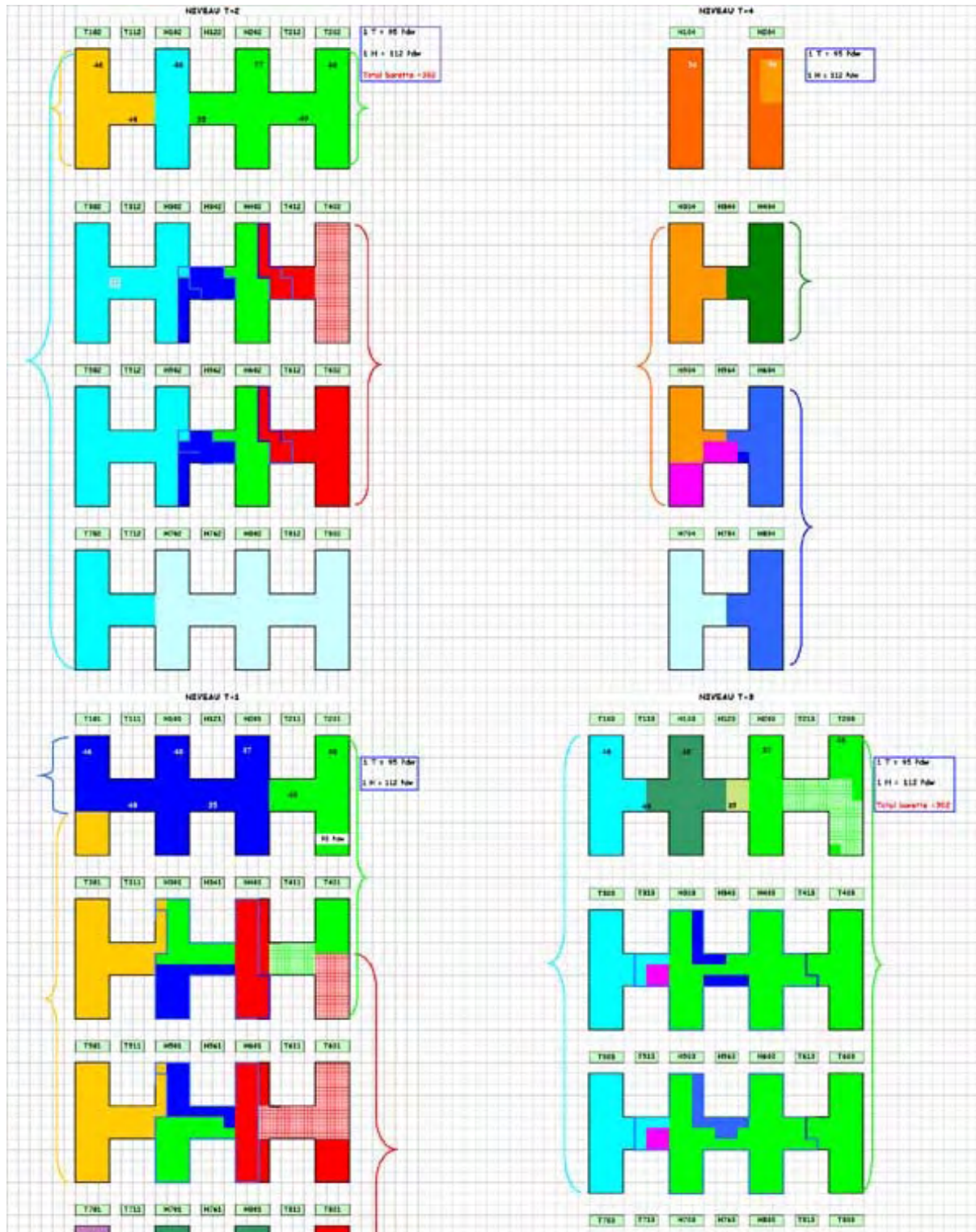
Figure 9: Space allocation in the Ruche

3.4 Occupation management

Two aspects require detailing: the implementation of the functional master plan + project management.

3.4.1 The implementation of the funtional master plan

There was a need to move over 5,000 people onto the site. The relocating also included the aim of stabilising the attribution of trade division work stations.

3.4.2 The spatial management of projects

Project management raises a considerable difficulty when it comes to managing the occupation of the building and ensuring a high level of proximity. One aspect of this difficulty is due to the fact that projects are moved around on the site: the preliminary design in the Avancée, the decided project in the Ruche, the industrialisation first in the Proto and then, for assembly, in plants distributed across the world. Another aspect is staff management, given that numbers constantly vary during the development of the project. The growth phase, the en-route phase and the end phase can only be managed from within the limits of the surface areas. As a result, the attribution of work stations depends on the current phase of the projects occupying the floor levels. This means that management needs to balance the number of work stations provided for the growth and end phase projects. This process is made even more difficult by the fact that the number of projects, their start-up dates and growth curves undergo constant change.
This has resulted in the company developing three-year plans that detail the various development phases of each project and matches these against the necessary human resources. Although this provides a basis for managing the surface areas, adjustments are nevertheless necessary throughout the development of the projects.

Arbitration is often necessary. Depending on the importance of the project and the issues covered by the negotiations, this involves different levels of management.
The operational level of attributions is generally under the control of "correspondents" to be found in each department/division. They are advised and assisted by the person responsible for the site layout.

To provide functional proximity between concerned staff during the various project phases, the Ruche needs to permit a high level of flexibility in the attribution of work stations and in the provision of modular furniture. This explains the importance given to the standardisation of layouts.

(The case of the Architecture and Assembly division: how is it distributed within the Ruche, how many persons are allocated to the trades and to the projects).

In physical terms: On the basis of the functional master plan, the management consists in moving staff according to the progress of the project without having to move the furniture. Occasionally, it is necessary to transform a meeting room into a work station. The furniture is not moved when staff members or departments are redistributed. The staff keeps their telephone number and can use their computer tool on the new work station.

Challenge: proximity during a constant evolution (pie chart management), occupation level. Tool: computer tool used to track the attribution of work stations; network of correspondents within the user organisations supported by fm.

3.5 Management issues

The problems brought up by the analysis:

Flexibility is a performance element expected from the building. Considered as a means to attain first level objectives (production cost, production time), it nevertheless makes reference to various sub-objectives that depend on the position of the staff. In certain situations, these sub-objectives can be in conflict one another and raise an occupancy problem. This is the case in the current period of overload existing for projects underway or being begun. The increase in the number of projects generates a high demand for work

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stations. The Strategy and Location division has worked since the very beginning of the TCR project on finding ways to increase occupational density and is currently trying to find a solution by raising the occupation rate. Operational management is faced by a dual difficulty, on the one hand finding unoccupied space, which implies more time being given to space management, and arbitrating between project priorities or between project components (a project manager has suggested getting rid of the sub-contractors, which questions the fundamental principles defined in the master plan). The problem is therefore simultaneously the time required to carry out this operational management of surface areas and the incompressible time required for arbitration, aspects that are recognised as being of a managerial nature.

FM

Occupancy rate —— Occupancy cost

Flexibility —— Time

Vehicle cost

Proximity —— Projet cost

Users:
different levels:
organization, site
operations,
divisions, end-
users
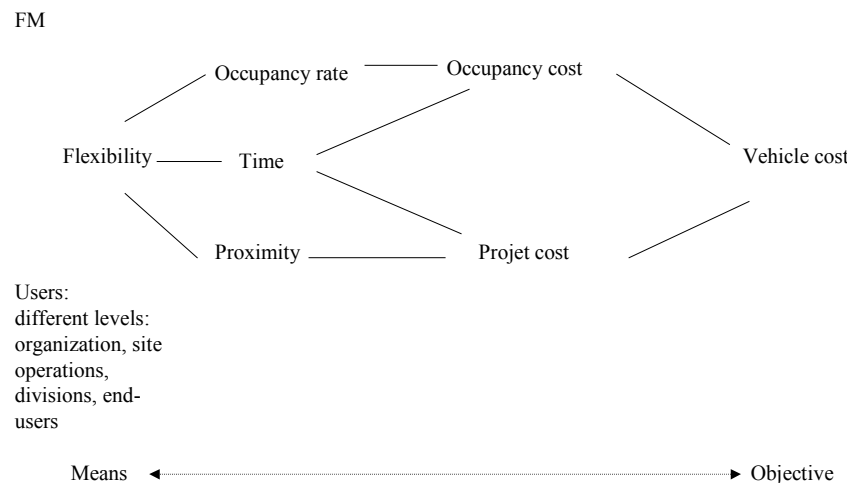
Means ◄——————————► Objective

Figure 10: chain of objectives

The problem of the distribution of responsibilities between the building services/FM and users/operator: the computer and human means are considered by some as insufficient, problem of delegating arbitrations.

The operational management fully recognises the benefits that it draws from the Ruche and its functional possibilities. In this overload context, we question the meaning of the statement affirming that the Ruche is a high performance tool that is nevertheless too small for the projects underway and those to be undertaken in the coming weeks. Within the framework of TCR activities, what should be considered as a "normal situation"? The statement appears to indicate that the users perceive the usability of TCR as being in relation to a situation previously experienced and not in response to the existing overload situation (resulting in the question of understanding what status is given to urgency and to the specificity of overload situations). Overall, the issue of the purpose of the Ruche does not appear to be frozen in time or fixed, but rather the subject of continuing questioning (usability depends on the situation in which those concerned evaluate the relevance of the device).

4   Perceptions of the TCR and of its contribution to the objectives pursued by the organization

The aim of the present study is neither to carry out a quantitative evaluation of the building's performance or efficiency, nor to carry out "measures by observation". We have not had direct access to formal evaluations (apart from a study carried out on user perception of the services provided by the maintenance department). The strategy and layout division is currently carrying out a survey to evaluate the satisfaction of the personnel insofar as the

site and the way it is occupied are concerned. At this stage, no other evaluations have been carried out.

Aspects of contribution of the TCR to the organisational efficiency that we describe here are drawn from discussions and the cross-referencing of information. They are based on perceptions (interpretations) expressed within the organisation (here or elsewhere state several user categories), they are advantages perceived through the experiences users have made with the building.

Objectives		contribution of TCR
Transformation of the company and its industrial strategy:	this consists in moving from a logic essentially based on production and multi-products towards a logic of product creation and development. This transformation should also have an impact on the brand image.	the grouping of concerned persons on a single site, the environmental policy operated on the site, the process of redefining the site layout policy, and the architectural quality.
Constant adaptation of the organisation to the development activity:	this concerns providing the management with the necessary means for each project both in organisational terms (the constant remodelling of the org. structures) and in terms of means, including working space (to be able to follow the progress being made by the projects as closely as possible). The constant adaptation of the physical means provides the management with the capacity to evaluate the relevance of the organisation throughout the development process and provide an adaptation in line with the relations between trades and project.	Flexibility in the attribution of surface areas/ means to make this possible: the proximity between all those concerned during the duration of a project, the simultaneous development of several projects, including the rapid integration of new projects, a satisfactory occupancy level.
Economic efficiency:	this concerns reducing the vehicle production cost through project management, as well as fully controlling the occupancy level.	Management tools (computers, correspondents).
Quality of life:	human resources management, satisfaction of final users, image.	Environmental treatment on the site, architecture, services offered to occupants.
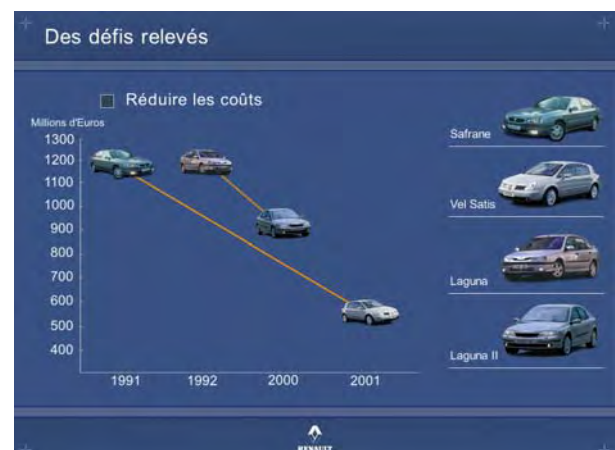
Figure 11: Results published by Renault: Reduction of development time in month, Cost reduction in Euros

The concept of "usability" can be appreciated in several dimensions / aspects of the TCR's occupation.

In a manner that is transversal to these aspects that are, at least partially, present in the criteria that the company applies to the site's management, we could state that the concept of usability makes reference to functionality and economic efficiency as well as to an learning process that takes place through the occupation and that contributes to the relevance of the organisation.

5   The experience of use

Changes in the perception of utilities over time.

Divergent intentions.

Learning
In relation to the initial concept:
Intelligibility of the new organisation and the weight given to projects and trades.
Intelligibility of priority objectives in the field of development.
Intelligibility of the progress for each project.

The experience of practice:
The importance of proximity (given that this is an important problem for the management).
The need to constantly adapt the tool.
Arbitration concerning occupation clearly expresses the management's problems: which project takes priority, which action needs proximity.

6   Contribution to the concept of usability

The potentiality of practices is not the potentiality of uses anticipated at the moment that the building was designed (jointly decided by those involved in the building process and by members of the management), but rather the potentiality of new forms of occupation based on real practices (presupposing an experience of the location and a knowledge of the adaptations between the action and the space). In return, this obviously raises the question of the "parallel" management of the company's human and spatial resources.

The building's margin of manoeuvre > experience > new interpretation of the margin of manoeuvre > new organisational behaviour / modification of the margin of manoeuvre.

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Projet Manager during the planning process

Case study: Nord-Trøndelag University College, Nylåna, Røstad, Norway

May 2005

CIB Task Group 51

USABILITY OF WORKPLACES

Case study: Nord-Trøndelag University College
Nylåna, Røstad

2005 - 05 - 10

SINTEF

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Contents

1 SUMMARY

This is the case study report for the fifth workshop of the CIB TG51 – Usability of workplaces. The object for this study is the Nord-Trøndelag University College at Røstad (HiNT), and the building Nylåna.

The building was finished in 1999, and is housing the General teacher education, Pre-school teacher education and the Nursing education section. We also find the common library, canteen and auditoriums for the University College here. Since the building was finished 6 years ago, the number of students starting their studies at the Røstad campus, has increased by 1000 from 1500 to 2500.

In this report the concept of usability is discussed, looking at the different perspectives considering usability during the different phases of the planning process to the building in use. In the introduction, we give an overview of different factors inluencing usability from Norwegian standards and legislation.

As part of the Norwegian contribution to the project, we take the development of the theoretical framework of usability of buildings in the CIB TG 51 a step further.

This case is studying the consistence of the planned and the completed building, and the building as it is today, 5 – 6 years after handling over. This includes how the different users like students, teachers and other staff evaluate the usability of the building and the validity of the planned building related to the situation today, and from the perspective of change.

The report and findings are based on project documents, interviews with 4 key actors in the planning and construction process. For evaluating the building in use, the findings are based on interviews, workshop including a walk-through and a user survey among students and staff using the building. For the survey we used a standard building questionnaire developed by Building Use Studies, to benchmark this building against a greater number of UK buildings.

Looking at aspects concerning the planning and construction phase, we have only 4 interviews to base the findings on. Still we have some indicators on conditions that could have an influence on whether the result is good or bad in a usability perspective. The real process being investigated is discussed and seen in the light of the planned process (the procedures and routines).

The findings from the building in use show a building that works quite well, considering the different aspects of usability. The survey gave an extraordinary high score compared with earlier UK benchmarks results. The Nylåna building came in the top 3% of the dataset using a wide range of user performance criteria. The comments in the questionnaire, the interviews and the workshop/ walk-through gave however a more nuanced picture, with special weight on problems regarded to the high number of students, complains about ventilation and temperature in specific areas, and a need for more group and seminar rooms. But all in all, the findings from the different methods being used are quite corresponding. In general we find that the users interviewed are quite satisfied with the building. Surveys made on a national scale also show that the students perceive the university college at Røstad as an attractive place to study.

Statsbygg, The Directorate of Public Construction and Property, has been supported the Norwegian part of the CiB TG51 project.

Trondheim 2005–05-10
Geir K. Hansen, Tore I. Haugen, Monica Jensø, Wibeke Knudsen, Kjetil Tennebø

2 INTRODUCTION

2.1 Usability – What is defining usability of buildings?

Usability is defined as the "*effectiveness, efficiency and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment*" [1].

Usability, with focus on the user perspective, is often a neglected aspect of building performance. Seen from a North-European perspective this seems quite odd as most planners, architects and facilities managers will claim that they are strongly concerned about the user perspective and the usability of the workplaces and buildings. The planners and building owners will claim that functionality of the workplaces is one of the important success factors for creating a good building. The well-being and satisfaction from the building users are also seen to be very important for some companies and FM-departments, setting a high standard for the work environment and support services for users.

In Norway we have had a strong focus on functionality and a tradition for user involvement in planning and design of buildings since the 1960ies, and we see that different issues related to usability are:
- described in public legislation concerning health, environment and safety for workplaces in buildings
- defined in building codes as minimum performance levels or specific technical requirements for buildings in use; example: minimum level of daylight in all permanent workplaces, minimum level of indoor air quality level
- defined in national and international standards for the building and construction sector setting both the rules of trade and describing approved measuring methods for quality levels
- reflected in common practice of user involvement in planning and design of new buildings in both the private and public sector

In spite of present legislation, standards and measuring methods, many buildings are still suffering from serious failures and weaknesses in performance and function, and there is a comprehensive potential for improvements. This shows that many buildings not are satisfying the requirements defined as part of the legislation, and also that legislation defining minimum requirements not is sufficient. A better understanding of the user experience of the building is needed to improve the understanding of usability from both a planning and management perspective.

2.1.1 The organization

Different organizations, in public sector or private companies, are characterized by various types of work, objectives and organizational structures. Organizations have individual objectives and intentions for what they wish to achieve by a specific building. The development of a new building, rebuilding of an existing, modernization or internal moves of workplaces are normally the result of an organization growing or shrinking, or organizational changes. In that respect the organizational characteristics are affecting the concept usability of buildings. A specific building can be usable for one organization, while another organization finds it unsuitable related to their needs.

During the programming phase, the user requirements related to the new building is stated; *"Programming is the fundamental activity in planning of buildings. The objectives and desired qualities of using the building are expressed and stated during the programming"*[2]*.* The programming phase is a process of systematic collection, documentation and information of requirements affecting the expected performance of the building. The involvement of the users during this project phase will influence the usability we can observe in the finished building.

A major challenge in the programming phase is the translation of the user requirements into a programming document, and further into a design solution. This work is done by external advisors or architects, not directly part of the organization. For the planners the challenge is to develop a programming document and a design reflecting the requirements of the user organization as well as all other requirements set for the project. The user requirements are also dependent on the context and setting of the organizations work, complicating this translation.

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[1] International Standards Organization, *ISO9241-11, Ergonomics of human system interaction.*
[2] Statens byggeforskningsinstitut, *Programmering.*

2.1.2 Standards and legislation

The major purpose of legislation concerning buildings is to secure that the health and safety issues for users are taking care of during planning and management of buildings. In addition the legal framework for controlling the building process focus on specific areas that have general public interest, like design of public areas, access for disabled and safety for workers. For workplace design and management we have two major laws in Norway, the Planning and Building Act[3] and The Working Environment Act[4] setting specific requirements concerning usability and user welfare.

National and international standards are part of the legislation, and developed to structure and control the different activities and trade between all the different actors in a sector. For the building sector we have a large number of different standards related to planning, design and construction and we are in the process of developing standards for Facilities Management. In September 2003 CEN Technical Committee 348 "Facility Management" was established with the aim to develop common European standards for FM terms and definitions as well as guidelines for FM agreements.

One important trend in a number of new standards is the shift from specified technical requirements for buildings and technical installations to performance-based standards based on functional demands and requirements. Usually functional requirements will be expressed in the programme document as a statement of the objectives, purposes, activities and functions of the proprietor or users. Current framework and conditions that must be present in the building project is also stated in the programme.

The Norwegian standardization system consists of several standards affecting usability of buildings in different ways. The Norwegian standard NS3455 Table for building functions[5] is emphasizing functionality of buildings. This standard has a structure and framework that can be used for developing a complete description of a building based on the functional characteristics. The standard might be used in programming of functional demands, control of functional aspects in design, planning of maintenance, life cycle analysis and independent evaluations and testing of functional characteristics of a building.

The ISO 9000's are a series of international standards dealing with the quality perspective in organizations activities and processes. Quality is defined as *"the ability to satisfy the customer demands and needs."* According to this definition, experienced quality will depend on the end product being in accordance with the customer expectations and needs. The customer in this respect will be the one ordering the service or product, normally the building owner or project manager acting on behalf of the owner. Whether the customer, according to the ISO definition, acts on behalf of the users, will depend on the degree user experiences and requirements are taken into account.

2.1.3 Measuring methods – Different approaches to the concept of usability

Until lately it is written and done little research on usability in buildings. Several research projects are done due to aspects concerning these concepts, but few are studying the connection and dependence between them. The terms are vague and little tangible. The concept of "usability" is widely known in relation to applications within product design, information technology and web-design, related to user friendliness and user interface of the system.

Different companies are measuring conditions related to usability and building performance in different ways. In accordance with The Working Environment Act the largest companies are performing regular internal examinations or investigations related to health, working environment, safety, user satisfaction and well-being. These investigations can merely occasionally be directly related to physical surroundings and building conditions. It is therefore a necessity to do a further development of measuring methods for this use.

Several terms are used related to different measuring methods for buildings. The terms building-in-use-studies, building diagnostics, building pathology and building evaluation are all used in this sense. The problem with these terms is that they are focusing on the building as a product, and do not include the process-oriented evaluation of the building process as a totality. It is essential to develop measuring methods including the time perspective in the building process and the relationship between the organization and the physical surroundings serving the organization.

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[3] The Ministry of Local Government and Regional Development, *The Planning and Building Act*.
[4] The Ministry of Labour and Government Administration, *The Working Environment Act*.
[5] Standards Norway, *NS3455 Table for building functions.*

Post Occupancy Evaluation (POE) was introduced in the 1960ies, as a response to considerable problems related to buildings functionality, especially from the user's point of view. Wolfgang Preiser[6], who is the pioneer in developing Post Occupancy Evaluation techniques, is an important contributor to this field. *"Evaluation of buildings-in-use"* is another name for POE, and it is a model identifying and evaluating several aspects of building performance from the user perspective. The model is assessing the match between building performance and user needs, and identifies ways to improve building design, performance and fitness for purpose. The POE model is representing the reverse process to programming, as is comparing actual performance with expected requirements and user demands. The programming phase comprises a translation of the user's objectives and purposes into a programming document. This is done by systematically collecting documentation and information of criterions due to expected building performance.

According to Alexander[7] et al., POE is a technique strongly tied to performance, and is traditionally a technique that is used after a building is taken in use. Alexander et al. also refer to "The Serviceability Tool", developed by Gerald Davis et al.[8], as one of the most spread practical and theoretical tools or methods to evaluate building performance. Davis distinguishes between performance and serviceability. He argues that "*Serviceability is about whether a building or facility is capable of performing as required. (...) Performance means actual behaviour in service at a given moment."* Davis defines serviceability as a broader term than performance. This indicates that his interpretation of satisfaction has a general meaning, and is not connected to individual values dependant on situation, context and time.

Alexander et al. expresses that POE and Davis's Serviceability Tool are competitive methods of evaluating buildings in relation to intended use. Both of the methods are emphasizing observation and measurement of certain physical aspects of the building or the facility, and evaluate this according to intended or actual use.

2.1.4 CIB Task Group 51 "Usability of buildings"

The CIB Task Group 51 "Usability of buildings" was established to apply concepts of usability, to provide a better understanding of user experiences of buildings. The objectives of the Task Group 51 are to carry out a series of case studies and associated workshops in a program of action research, to develop concepts of usability for application in practice, and to promote, develop and share methods, processes and techniques for the evaluation of buildings-in-use.

The case studies are carried through in co-operation with industrial partners, financing the research and participating in the case studies and the international workshops. The aim of the case evaluation and the workshops are to explore aspects of the usability concept. As every case is different and belonging to different contexts, new aspects of the concept is highlighted in every national study. A preliminary understanding of the concept is developing and become more and more elaborate with every workshop.

The UK case study[9] was the first one in this CiB Task group, focusing on the development of R&D facilities for NCR in Dundee, Scotland. The UK contribution to the Task Group is demonstrated through the use of a novel planning process. The case study is focusing user participation in the planning process, a feature still quite unusual in UK building projects.

Örebro University Hospital was chosen as the Swedish case study[10], and the group was studying the user's experience due to functionality and usability of the surgery centre, built in 1997. Their contribution to the Task Group is demonstrated through the analysis of the planning process, the effects of incorporating new technology and new work processes, as well analysis of the building configuration and layout.

The case study from Turku[11] was studying "The Old Mill" in Turku Science Park. The Old Mill is an old factory building, now offering office facilities to several IT-companies.

[6] Preiser, W., F., E. et al., *Post Occupancy Evaluation.*

[7] Alexander et al., *Usable workplaces*.

[8] Davis G. et al., *Serviceability Tool, vol 1 – 5.*

[9] Alexander et al. *Case study NCR, Discovery Centre, Dundee. Draft report. CiB TG 51*

[10] Lindahl et al., *Case study: Örebro University Hospital: The O-building. Draft report. CIB TG 51, Usability of workplaces.*

[11] Nenonen et al., *Case study: The Old Mill. Draft report. CIB Task Group 51 Usability of workplaces.*

The purpose of the case study is to understand the elements of usability in refurbished environments, and secondly to produce elements of use in the planning process of Old Mill 2, which is representing an enlargement of the building.

The French case study[12] was studying the vehicle design and development centre of Renault outside of Paris, limited to the occupation of The Ruche Building. The management of the company considered the implementation and use of this project to be an essential part of its change strategy in vehicle design and development. This led to a very ambitious approach, both in the architectural and landscape treatment of the building site, and in the way the building has to support ongoing change and improvement of the organizations processes.

2.2 Case study HiNT Røstad, focus area

As part of the Norwegian contribution to the work in TG51, we want to do a further development of the theoretical framework of usability of buildings. Our case study will be discussing usability, and the different perspectives considering usability during the different phases of the building process, includet the occupancy of the building. The case study object will be used to explore challenges and interfaces between different parameters in the framework, due to these approaches. Evaluations of buildings-in-use and feedback loops are important to improve the programming phase based on knowledge and experience gained during the evaluation process.

In this case study we will be discussing different stakeholder's perspective concerning usability, with a special emphasis on the user perspective. Evaluations and measurements of the consistence of the planned and completed building, including how the user's needs and requirements were defined, regarded, and how the project was developed and designed. The case study is also studying the consistence of the completed building and the building as it is today, five years after completing time. This includes how the users and the operational personnel evaluate the usability of the building today, and is studying the validity of the planned building related to the situation today, discussing which and how changes have been managed.

3 NORD-TRØNDELAG UNIVERSITY COLLEGE (HiNT), RØSTAD

3.1 Background

The teacher's education in this region was initiated by establishing Klæbu seminar in 1839. In 1892 Klæbu seminar was relocated to Levanger, and this was the basis of the educational institution we today know as "The teaching school" in the centre of Levanger. This building was taken in use in 1900. 99 years later the Department of Teachers Education was relocated in new modern localities at Røstad. In 1939/40 Innherred nursing school was established, with a nursing education lasting for 3 years. The education of engineering was assigned to Nord-Trøndelag University College in 1989. The University College at Levanger was founded in its current state in 1994, and today these institutions are a part of the Nord-Trøndelag University College, as the Department of teachers' education, Department of nursing and Department of engineering.

In the end of the 80ies, before the establishment of Nord-Trøndelag University College (HiNT), the existing institutions were planning a closer cooperation and a co-localisation in a new building. HiNT had an acute need of area due to the establishing of the engineering education, and the choice was Røstad, close to the north of the town centre of Levanger. The Røstad area originally consists of a farm and a school building. The school, dedicated mentally deficient children, has been operating since 1903. A farm and a gardener nursery were run as a part of the school. This school was deposited in 1992, but the farm house, the servants' hall, the main building and the store house are preserved.

In addition to these old buildings it is built two new buildings for the university college the last decade (completed in 1999 and 2002), for the purpose of administration and teaching. Due to moving to the Røstad Campus, the different areas of study for the first time were assembled at one campus. The Campus has an area of 500 decare (a quarter of an acre) cultivated land, and consists of a composed and complex group of buildings, totally 28 000 sqm, of varying age and use.

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[12] Fenker et al, *Case study: Technocentre Renault in Guyancourt: The Building La Ruche. Draft report. CIB TG 51, Usability of workplaces.*

The Norwegian Directorate of Public Construction and Property is the owner of the area, and it is used by The University College at Levanger and The National Support System for Special Education (Statped). Today totally 2 500 students and employees have their daily work at the campus.

3.2 The case study project: "Nylåna"

Our case study is limited to the building completed in 1999, called "Nylåna" ("The New Pile").
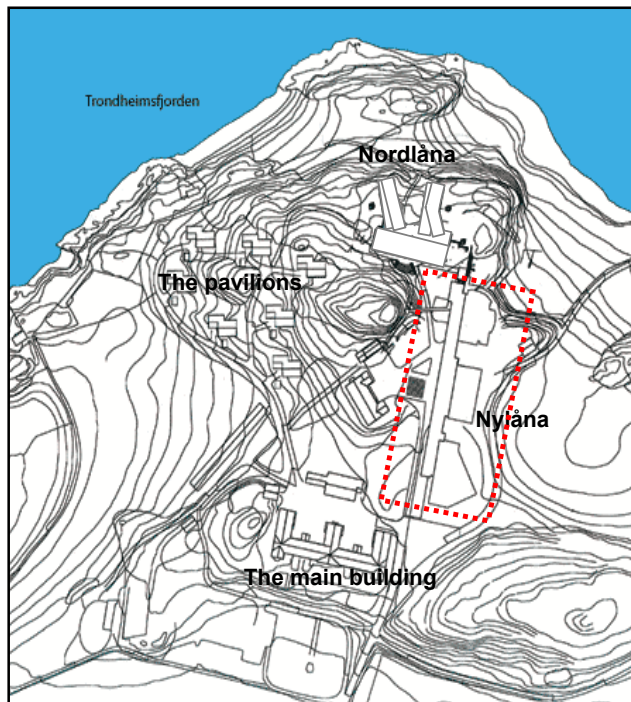
3.2.1 The building process

The planning process was initiated in 1992 by an open architect's competition. The winning project, "ABC", was developed by HUS Architects from Trondheim. A long lasting and difficult planning process arose, because of a lack of funds granted via the National Budget. Not until 1997 the project received the necessary funding, and the planning could proceed. The building process started in March 1998, and was completed in August 1999. The total cost for the completed building was 164 millions NOK. The completed building is at totally 10 800 sqm (11 160 sqm gross area), and contains both offices for the administration and the teachers, together with several teaching facilities.

At the official opening of the building in August 1999 Gudmund Hernes, the Minister of Education, declared that "Røstad is the most beautiful campus east of California". The building got the name "Nylåna", in line with old tradition in that part of the country.

3.2.2 A description of the building and the area

Røstad is located close to the centre of Levanger, in a picturesque and wonderful landscape near the fjord. Together with being used by HiNT, the area is popular for the local population as a nice area to go for a walk and going swimming in the summer. Localization and building of the Nord-Trøndelag University College here at Røstad has resulted in a revitalizing of an area close to the centre of Levanger, that earlier has been partly closed for the public.

Picture 1: Site plan.[13]

The following objectives have been central during the planning of Nylåna;
-to strengthen the characteristic culture of the farm and the yard
-to consciously deal with the distinctive character of The Main Building and the belonging garden
-to integrate special qualities of the landscape, vegetation, topography and view.
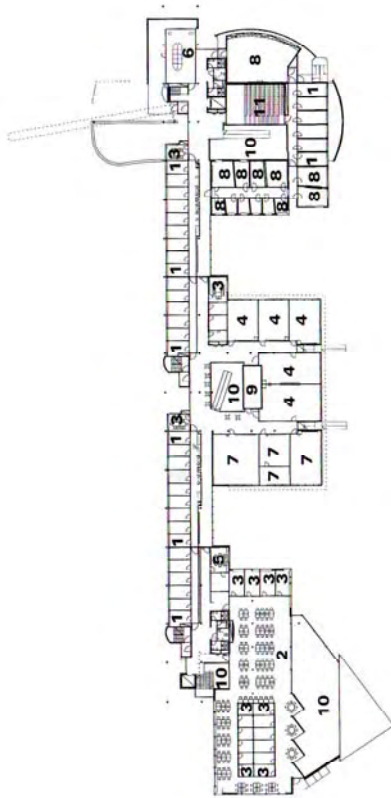
The area is a cultivated landscape, alternating between open cultivated areas, wooded hills, parks and buildings for operating the area. The landscape is also characterized by historical grave-mounds and a partly utilized beach area. The special qualities in topography and vegetation are making strong requirements on the new buildings.

The building "Nylåna" is defining, together with the Main Building, the cultivated landscape from the yard, equivalent with the old barns.

"Nylåna" consists of three almost independent buildings, connected by a corridor and the teachers' offices. The three parts of the building has its own expression, in architectonic interaction, which is representing the diversity in content and purpose of the building.

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[13] Statsbygg, *Høgskolen i Nord-Trøndelag. Røstad.*

According to the distribution and use of area, the library and reading rooms are located in the south building volume, adjacent to the entrance of the building. The middle building volume is in use for dry teaching areas, with 3 auditoriums, seminar rooms, media, IT and a linguistic laboratory. The special rooms belonging to the different departments are gathered separately, in the north building volume.

Level 1 is containing all larges functions generating most traffic.

Level 2:
1 Offices
2 Reading room
3 Group room
4. Seminar room
5 Student organization
6 Meating room
7 IT/language/media
8 Music
9 Technical room
10 Open to the level below
11 Auditorium

Picture 2: A characteristic plan. Level 2.

3.2.3 Use of materials

The building has principally a traditional use of materials; masonry, brick, glass and wood panelling. Modern materials, together with shapes of our time, give the impression of a modern building.

Picture 3: Façade facing the yard.

Picture 4: The main entrance[14].

The building has different external expressions towards the yard and the surrounding landscape. This is achieved by using different materials; brick at the facades facing the surrounding landscape, wood panelling facing the yard.

The interior use of materials consists mainly of painted plaster boards, bricks and concrete. In the entrance halls the concrete surfaces is given a special visual quality.

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[14] Statsbygg, *Hovedinngang.*

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The common areas have a floor of polished concrete, while teaching and office areas have a floor of linoleum and vinyl. Artistic decoration is located to the central areas, like the library and the two main entrance halls.

Picture 5: Corridor 1. floor

Picture 6: Staff office corridor

Picture 7: The main stair

The co-localization gives a great opportunity for studying across the lines of traditional educations, and it is prepared for a comprehensive interdisciplinary cooperation.

Picture 8: The library

Picture 9: The canteen[15].

Picture 10: The nursing department

3.3 A further need for facilities – "Nordlåna"

In the planning and building period of "Nylåna" there was an increase in the number of students and employees at 50% (600 students and 60 employees). Before completion of this building there was a need for further expansion on the campus, for the purpose of teaching and administrative offices. In October 1999 the government approved planning and building of the new project "Nordlåna" of 3 700 sqm., this building designed by the architects called Letnes Arkitektkontor AS.

"Nordlåna" was completed in August 2002, and is not a specific part of the case study. Together with this, 1 440 sqm existing buildings was also renovated.

Picture 11: Nordlåna.[16]

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[15] Statsbygg, *Kantine.*
[16] Statsbygg, *Fasade inngangsparti.*

4 CASE STUDY –PROJECT MANAGEMENT, ROUTINES AND ORGANISATION

4.1 Statsbygg

Statsbygg[17] is responsible for organising, planning and completing building projects within set frameworks for budgets, time limits and quality. The buildings must meet quality requirements regarding to architecture, functionality and environmental concerns.

Statsbygg operates as an owner, real estate manager, owner and advisor in construction and property affairs. Their portfolio consists of office buildings, schools, accommodations and specialised buildings throughout the country and embassies and residences outside Norway, and these are all rented to governmental renters. With a total floor space of over 2,5 million sqm, in Norway and abroad, Statsbygg is one of the leading real estate managers in Norway. In total, Statsbygg's annual building budget is approximately NOK 2,3 billions.

Statsbygg as an organisation consists of the head office in Oslo and five regional offices. Statsbygg is divided into three divisions; the Property division, the Project division and the Development division. 278 of its 669 employees are based at the head office, approximately 95 at the regional offices, and almost 296 are engaged in the operation and maintenance of Statsbygg's properties.

4.2 Project organisation / development

Statsbygg normally organise their projects in nine stages, with four main phases. These are; Programming, Design, Construction, Hand-over. The Property division is responsible for the early stages of the project. After the early examination of needs and completion of a Statement of need, the project is transferred to the project division, responsible for carrying out the project. At the completion of the project the building is transferred back to the Property division[18].
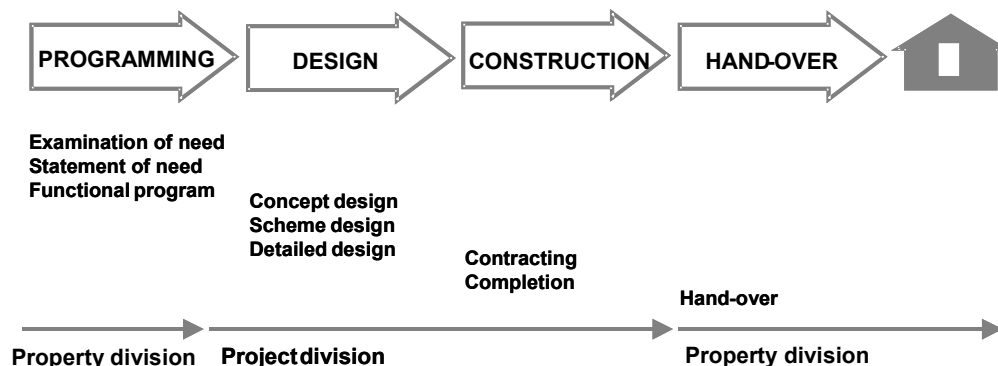

Figure 1: Schematic overview of Statsbygg`s project organisation.

4.2.1 Phase 1: Programming

Stages: Examination of need, Statement of need, Functional brief.

The process starts with an examination of the need for a building, what function it should have and condition of existing buildings. The goal is to formulate the important premises for the project. This means to unveil and describe the demands of the business and examine and define which demands the building has to fulfil. This involves the users at an early stage, and the users are given support from Statsbygg. Statsbygg is responsible for organising the work, collecting important factors, clarifying uncertainties, investigating consequences, illustrating solutions and making an end document that can be used for the rest of the process.

In the next stage, the "Statement of need", an analysis of functions is made, and the users start to specify their needs of space and make a preliminary project plan. This is a mapping of the business's functions, organisation, size and communication internally and externally.

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[17] *Statsbygg, The Directorate of Public Construction and Property is an administrative body, responsible to the Ministry of Labour and Government Administration.*
[18] Statsbygg. *Hushjelpen.*
  Prosjektdivisjonen, *Instruks, PI 11-11-1; "Skjema som beskriver prosjektets utvikling"*

It is important that the situation of both today and tomorrow is described. The net and the gross area for the project are established. When the superior authority approves the statement of need, the users need to consider alternative ways of achieving the goals of the statement of need. The alternatives can be to rent or buy an existing building, build a new building, reconstruct an existing building or make an addition to an existing building.

The result is a temporary programme / statement of need, which the Property division hands over to the Project division. The Project division is responsible for making the brief.

In the next stage, called "Functional brief", the project group in Statsbygg is settled. This is an internal project group with an internal leader. A proposal for functional brief is made, with illustrations and analysis. The building budget and rent costs are calculated / stipulated, and the building brief is sent back to the users for their comments / evaluation. The project group work out a project plan, and if needed the design team is pre-qualified.

Building budget, rent costs and project plan is presented for the board, and if accepted the Project division is given the final project commission, and a project plan is made. This acts as a foundation for the design- and construction phase. Which project execution model they choose, depends on the complexity, timeframe etc. of the project.

4.2.2 Phase 2: Design

Stages: Concept design, Scheme design, Detailed design.

Statsbygg is responsible for making the tender documents and inquiries etc. In the process of engaging the consultants, Statsbygg is determined to follow the rules of the "Public procurement act" and "Rules of public procurement operations". Statsbygg engage an external design group consisting of architects and consulting engineers. The design group starts the "Concept design" stage, which consists of plans, sections, elevations and superior plan with costs.

In this phase, the demands of the functional brief is detailed, concretised and illustrated in order to form the tender- and working documents for the contractors. The brief is controlled and checked.

After the concept design, follows the "Scheme design". In this stage the design group develop technical solutions with costs, perform detailed control of the brief, and most important make the contract plan and building budget.

On background of the scheme design, the design group makes a "Detailed design". This implies completion and control of the tender and bidding documentation.

At the end of this stage, the construction manager is contracted. The construction manager is responsible for the daily follow-up of the progress, quality and invoice control, and reports directly to the project manager. Construction meetings are held frequently. Participants are the project manager, the construction manager, consultants and the contractor. At some of the meetings the representative of the users also attends.

4.2.3 Phase 3: Construction

Stages: Construction, Completion.

The construction stage and the detailed design stage are partly parallel stages. In the first part of the "Construction stage", the tender and biddings are sent out to contractors. When the biddings are completed, the design group give their recommendation, and the contract is closed. To be qualified for the contract, the tender has to be within budget. When the contractor is given the project, the construction starts.

In the construction phase the project manager is responsible for continuous cost surveillance.

Finally the contracts are completed and inspections are done. The project is handed over from the Project division to the Property division. This stage is called the "Completion stage".

4.2.4 Phase 4: Hand-over

Stages: Hand- over

The building project is completed when the owner perform an inspection to ensure that the building is ready for occupation. If any defects are detected, this should be improved within a common deadline.

The building is finished and officially opened. The project is handed over to the users, with guaranties and complaints. Project information and information about maintenance, facilities etc. is archived.

4.3 User involvement

User involvement is generated through the user group or the user co-ordinator. All primary functions and departments are normally represented in the user group. According to The Working Environment Act the labour organisations also should be represented in the user group. To support the involvement of the users, every project establishes a contact group with representatives from the owner (department), users and Statsbygg. This group has an important function being the joint between the project leaders in Statsbygg and the users. This group has to approve the project at the end of each stage, and take an attitude towards new demands or changed conditions in the project, which will lead to changes in space and cost budgets.

5 METHODOLOGY

The case study is accomplished as a combination of a descriptive and a normative research approach. The descriptive approach is carried through as an examination of how the building process and the different procedures are accomplished. We have been combining several methods, like studies of project documents, a walk-through in the building, interviews with central actors in the process, and a more extensive user survey. The normative approach is carried out by organizing a workshop with different users, where the users themselves were invited into the work of evaluating criterions of usability of buildings. Criterions of usability, developed and discussed in earlier international Task Group workshops, were discussed and taken further, in light of validity in our case study.

5.1 Criterions

As a supplement to the present framework developed as part of the international workshops, we wanted to do a further discussion of criterions for the concept of usability. We wanted, in a more extensive way than the earlier case studies, to stress crucial criterions considering usability of buildings, and accordingly be choosing to discuss and do evaluations related to some of them.

A workshop with researchers and academics from NTNU and SINTEF was accomplished 18.05.2004[19], as an introduction to the work with the theoretical framework. The objective of the workshop was to reach a common understanding of the term usability and to define and explore the content and aspects of the term, together with discussing relevant methods and tools to be used for measuring usability of buildings.

5.2 Workshop and walk-through

The preliminary part of the work with the users at HiNT was arranged as a workshop 25. November 2004. The main purpose of the workshop was to discuss the concept of usability in different users' point of view, and to identify the users' criterions for evaluating the usability of Nylåna at HiNT, Røstad. We emphasized to involve persons with different perspectives and functions related to the building, to unveil various experiences due to the building in use. Users participating were thus students and teachers from the main areas of study, personnel from the administration and staff, operational personnel, and a representative from the local department of Statsbygg. Totally 9 user representatives were present. (The same 9 persons also participated in the walk-through of the building, described below).

In advance of the workshop, the user representatives were asked to do a homework, consisting of doing some reflections considering crucial conditions for the buildings suitability as a building for education and working.

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[19] Hansen, G., *Usability of workplaces. Innhold, begreper, kriterier. Workshop 18.05.2004. NTNU, Trondheim.*

As a part of the workshop there was arranged a walk-through in the building. A floor plan was distributed to the user representatives, and they were guided through the building making stops at 8 chosen points, doing an evaluation of usability. The 8 points were the main entrance/entrance hall, the canteen, the library, the reading room with rooms for group activities, offices for teachers, administration and staff, the music section, the health education, and finally an evaluation of the totality of the building. The users were at each of these points asked to write down their positive and negative impressions, together with a potential for improvement.

5.3 Interviews

In the period from November 2004 to January 2005 we were interviewing actors from the planning phase and from the phase of building in use.

Interviews with 4 actors from the planning phase included both professionals (the architect and the project manager) and user representatives (user coordinator and user representative) participating during the programming phase and the design phase. The interviews were focusing to unveil aspects and processes in the planning phase affecting the usability of buildings.

To discuss the building in use, we were interviewing 4 user representatives with different perspectives and functions in the building. These user representatives were the same attending the workshop and the walk-through. These persons were representing a broad sample of users, offering a wide span in experiences and opinions due to the use of the building. The interviews were focusing user experiences from the building in use, particularly the relationship between the users requirements / needs and what the building offers.

Interview guides were sent the interviewees in advance of the interview, to give them a possibility to do some preparations, and a summary of the interview was transmitted for approval after the interview. General impressions and citations from the interviews are used as basic information for this draft report. To gain a sufficient confidentiality citations are done without mentioning the interviewees by names.

5.4 User survey

A user survey was developed working together with Adrian Leaman[20], using his existing user survey, a standard building user questionnaire developed by Building Use Studies, as basis. This was interesting to use in this case study to do comparisons and benchmarking against a number of UK buildings. Some adjustments had to be done due to the category of users and building. In the building usability study we were assessing how users perceive how the building works, especially in the ways it enables them to carry out their work effectively. In particular the survey was focusing on;
1. The overall context of the building
2. Opportunities for users and building managers to intervene and change things for the better¨
3. The ergonomics of individual users´everyday experience of the building

The survey was handed out/distributed to 600 users of Nylåna, both students and employees. Students and staff were surveyed seperatly. The response was totally 177 (48 employees and 129 students). The outcome of this survey was processed by Leaman, producing a survey report with a summary of the results, presenting main findings on usability and benchmark comparisons with other buildings.

Studying the results, we see some differences due to the different countries traditions and focus in the programming and design of buildings. In this survey, questions is of a very high detailing level related to indoor climate. The questions of the survey are at a superior level, and the detailing level of the questions due to other aspects of usability is too low to indicate what should be done other wise in Nylåna. This may be reflecting that in the UK this is a crucial criterion due to usability, while in Norway we have many regulations that are taking care of those aspects. In our country we thus need to focus on other aspects of usability.

Summing up, the survey being one part of the case study, supplementing the interviews with the users and the professionals, we consider the survey to be interesting and to give a proper basis to evaluate the building.

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[20] Leaman, A, *Building Use Studies Ltd.*

6 FINDINGS – ASPECTS CONCERNING THE PLANNING AND CONSTRUCTION PHASE

Findings in the planning and construction phase are brought out through interviews with four members of the project.[21] The findings focus on the user organization, the design competition, the project management, the contract and the time aspect.

6.1 General

6.1.1 The user organization

Organizing
Starting up, the user organization consisted of one user from each line of study, together with the director of department from each school. The user group was pointed out by the headmasters of the three institutions. A coordinator was leading the user group. After completion of the programming phase the user group got a new coordinator.

During the design phase the user group grew from 7-8 persons to 11-13 persons. The user group reflected the size of the different lines of study. There were also discussions about balance in the user group. *"The group got more representatives of students, because there were so many other representatives."* The laber union did not have a formal representative in the user group. This caused noise made by a representative from the teachers association, later in the project's hand-over phase.

Participation through different phases
In the programming phase the study of area requirements was based on existing area and activities. Each line of study defined their needs of area. The need of area was passed on to the project manager. He formulated the program based upon the user needs and standards of area. The entered user needs area was exceeding the final program formulated by Statsbygg with about 200 sqm. What the users perceived as lack of area caused a lot of frustrations among them.

In the design phase the common headmaster of the three lines of study was the formal leader of the user group. User participation in the project was ensured through the user coordinator. He participated in design meetings, and brought issues to discussion in the user management. Special topics were discussed in meetings between users and the architect, where user demands, requests and solutions were examined. The user group decisions were based upon discussions. There were public meetings with the units led by the coordinator or by the representative from the unit.

The users had discussions about location and design of special rooms. The teacher training section had internal meetings about their planned solution. *"The architect made an excellent section. We are very satisfied with the rooms for special use."*

The user group didn't plan common functions, such as locker rooms and meeting facilities. They thought these area categories would be defined by the builder, Statsbygg. As a result these area types were not a part of the final program.

Challenges
The users feel they should have had professional help during the process of defining their needs. *"We had no training or assistance from Statsbygg during the process." "An OK process, but a process brought out by amateurs"*

The user group never obtained an authorization for their work from the builder. This marked their work. *"We had a groping start. The work was defined little by little"*

Some of the user representatives strived in involving their organization. The education of teachers wanted to move into new locations at Røstad. This section managed to involve their organization. The nurse training school was located in a newly renovated building at Levanger, and did not want to move to Røstad. Their user participation mainly constituted of their representative in the user group. *"There were a lack of interest and involvement within the line of study"*

"One of the biggest challenges was the change of representatives. In the section of drama the representative of users wanted a black box. Later on a new representative for the same section wished for a hall with daylight. But this was too late in the process.

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[21] Interviews with 4 actors participating in the planning phase.

With new representatives came new demands and new ideas on function and form". Demands were individual, and not based upon common demands and choices in the section.

Climate

Both the architect and the representatives of users point out that there were a lot of disagreements between them. There were also tensions inside the design group. The architect had expectations to the consulting engineers participation in the process, which they did not fulfil. There were also a conflict between the architect and the leader of the design group, which led to replacement of the leader. Later in process the collaboration between the architect, project manager and the user coordinator was characterized as good.

6.1.2 The design competition

The program

The University College at Røstad is part of an old, cultivated landscape. The history of the farmyard goes back to the Iron age. The purpose of the design competition was to bring forward the best architectonic answer to a University College for the future that:

- *"Strengthens the characteristic country courtyard at Røstad.*
- *Gives answer to the main building and the surrounding gardens distinctive monumental and symmetrical design."*

The panel of judges

The panel of judges consisted of representatives from the builder, the users and representatives from The National Federation of Norwegian Architects (NAL). The winner of the design competition was pointed out with dissenting votes from the jury. The representatives of the users wished for another winner. The winning project caused demolition of a barn, an important part of the old farmyard. The user representatives meant the winning project therefore was in conflict with the intention of the program. The users even tried to get the decision made by the panel set aside. A delegate had a meeting with the Minister of Education. The result of this meeting was negative.

The architect

In designing the project the architect tried to expound the functional demands given in the program. The winner of the design competition thinks he won because it ensured the functional schemes shown in the program. As an architect you must choose a design approach: *"Do you design to win the competition, or do you design to make a project of good quality?"*

6.1.3 The project management

During the process from design competition to complete building the project had 5-6 project managers. The replacement of project managers caused frustration among the users and the architect. The architect felt like he was the one representing continuity in the process. The last project manager is getting credit for being pragmatic and establishing flow in the design and construction phase.

In the construction phase the user coordinator worked as the connecting link between the users and the project manager. The project manager only knew the coordinator. Results of the users' decisions were passed on to the project manager. The project manager in the construction phase is satisfied with this model, and experienced good results. He does not know how the users experienced their situation. The coordinator also expresses satisfaction in interaction with the project manager. On the other hand the users experienced that the coordinator made decisions on his own, without consulting the group.

6.1.4 The contract

The architect won a design competition and had, according to the firm, a reasonable fee. The consulting engineers got the job through price competition. They had given low quotations in order to get the job. To avoid loss of money, some of the consulting engineers tried to minimize their work. This caused a great deal of frustration for the architect, who anticipated they would contribute more to the process.

6.1.5 The time aspect

The program was approved by the Ministry of Finance in 1992. The design competition was held in 1994, and the building was completed in 1999. At the day of completion the number of students had increased. During the planning process the design group knew the project would be too small. The shortage of space was solved temporary through the use of barracks, and later through building a new project called Nordlåna, placed adjacent to Nylåna.

6.2 Factors influencing on future usability

Missing area
Experience has shown that the program missed functions such as locker rooms and meeting facilities. These are common functions where the user group through programming would be taken care of by the builder, Statsbygg. This shows that a lack of planning and functionality in the planning stage, directly influence on future usability. The framework describes how the builder is to support the ongoing user process. The users have in this project given a clear expression that they missed training.

Redistribution of area
In the design phase the users were unwilling to discuss redistribution of area. The architect means this can be put in connection with the structure and design of the program. *"The program was characterized by a "room by room" planning."* This gave the users a strong sense of ownership to specific rooms. Looking back, both the users and the architect admit that redistributing space within the program could have given them the area they now are missing.

One example to illustrate this, is the offices for educational staff. This section is in lack of informal meeting places. All employees have single offices of 10 sqm. If the single offices where reduced to 6 sqm, this would have released area that could have been transformed into space for meetings. Instead an increase of the space budget with about 160 sqm, in the design phase, was used to design a double corridor. This double corridor was to separate area for educational staff from the area of students.

Another example is the co-localisation of 3 libraries. The program contained 10 offices which matched ten employees in the former three libraries. The new library would need 4-5 employees. Still it was impossible to redistribute area and instead establish a general office. The argument used was the following: *"You can't resign employees in design meetings"*

A better training of users and continuity in the project management might have led to a higher degree of usability in these issues.

Pedagogic principles
The program did not contain visions of educational science for the future. From the program of the project was established and up until today, there has been a change in educational science. From teaching the students in auditoriums, the training is now problem based. This provides more rooms for seminars and group activities, and the auditoriums have a lower frequency of use. The future has shown that the lack of visions for educational science in the programming phase, has given a result where the area does not support the ongoing educational processes. Problem based training was a known concept in the start of the 1990ies.The framework underlines the importance of investigating needs of the future. Better training of the users and a better analysis of future needs would probably have given quite another output from the programming phase.

Decision approaches
During the construction process the users wanted to use the shelter placed in the basement of the building for several functions. The floor was concreted before the decision of using the area for shower rooms could be taken. Users point out that a more rapid decision making in the construction phase could have given a more user-friendly project.

Working well
The architect is getting a lot of credit from the users for showing interest and being able to examine needs, details and functionality. Meetings on special topics where user needs, requests and demands were examined, worked well. Users put forward special areas like the nursing department, as areas with high degree of usability. This coincides with area where users perceived to have had influence on design.

6.3 Other significant factors

There are several factors in the planning process that is important to mention, but that can't directly be traced into future usability;

Lack of authorization
The user group experienced to be in lack of authorization for their work. This led to a grouping start, and work was defined as time went by. From the interviews it is hard to tell if this lack of authority led to a loss of future usability, but the user group could have had a more focused and better process if their authorization had been clearly defined.

Involvement inside the lines of study
The change of user representatives was a problem during the design process. The demands of users were individual, and not based upon demands and choices inside each section. An involvement of users inside each section would have ensured commitment among the user representatives. This way the replacement of representatives would have been a minor problem. A higher degree of involvement could have been handled through training of user representatives and routines describing how the user organization was meant to work.

Climate and contract
The climate both inside the design group and between the design group and the users were at some points filled with conflicts. The different contracts between the architect and the consulting engineers were the source of conflicts, as the participants had different ideas of what way and to what extent they were to contribute to the process. How this affected the functionality in the output of each design stage is hard to tell. It is therefore difficult to point out if and how these conflicts have influenced on the future usability of the project.

The design competition
The user representatives in the panel of judges wished for another winner in the competition. *"The users scepticism to the winning project, and the attitude towards the dissenting votes of the jury, had anchorage inside the users organization."* It is hard to tell if this conflict at an early stage in the process has affected the future usability. But the attitude towards the project inside the user organization was influenced.

Discontinuity in the planning and construction phase
When the planning and construction phase goes on for several years, it is a challenge to establish continuity. Both the project management and the user organization had several changes of personnel, which caused frustrations among the participants in the process. Based on four interviews it is hard to tell if and how a lacking history, commitment, culture, decisions etc., affected the output of each planning stage, and thereby the future usability of the project.

Working well
The project manager in the construction phase is getting credit for being establishing flow in the construction phase. Both the project manager and the coordinator were satisfied with their collaboration. The user group had a positive attitude towards the project. They were looking forward to moving into the new building. This is probably because they perceived involvement and ownership to solutions in the project. It is hard to tell if these relations between participants in the process directly led to a higher degree of usability in the project, but it ensured positive experience and attitude among participants.

6.4 Summing up

Summing up findings from the planning and construction phase it is important to have in mind that this is the subjective truth based on four interviews, as the interviewees remember it 5 ½ years after completion of the building. Some headwords can be connected to the concept usability:
Vital to future usability is:
>The output quality of each planning stage
>The transmission of knowledge between project stages / phases
>The planned capacity to adapt needs of the future.

A couple of questions are also related to the concept of future usability:
>Does a supporting process leads to better quality in results?
>Do you might have a great result despite a frustrating process?

7 FINDINGS – ASPECTS CONCERNING THE BUILDING IN USE

7.1 Workshop and walk-through

The walkthrough gives a simple and fast overview of the building, to find some indicators how well the building work. The summary of the walk-through is based on each persons individual evaluation of positive and negative impressions, and their suggestions for improvements. The walk-through started with a reflection on the usability concept and the users` perception of usability. The users[22] attached the following associations to the notion of usability:

> Contentment, functionality, accessibility, shape, climate / interior environment, satisfied user, independency and communication.

7.1.1 Summary of walk-through

Stop 1, The main entrance / entrance hall
Users experience the main entrance as a large, open and well illuminated area. They are sceptical to how well the entrance hall works in daily use. It does not function as a main entrance to the building. The users wish an addition of functions to this area, and also soft furniture that will invite to extended use of the room. A recurring comment is that the vestibule is experienced as disorderly. Simple actions, such as cleaning up, or moving and redesigning the information board, in addition to moving the ATM machine, can lead to a drastically improved room experience for the users. Some users experience the entrance hall as grey, and wish stronger elements of colour use on walls. Users experience the lack of an elevator in relation to the entrance hall as a negative aspect.

Stop 2, The canteen
Users are divided in their experience of the canteen. While some find it inviting, others see it as grey and sad. A recurring comment is that the service zone and kitchen are undersized. The canteen is also experienced as functional, and well suited for the serving of food to a high number of people. The service zone is experienced as impractical, with food items placed highly, and wheelchair access is difficult.
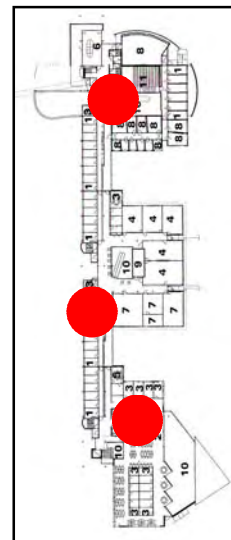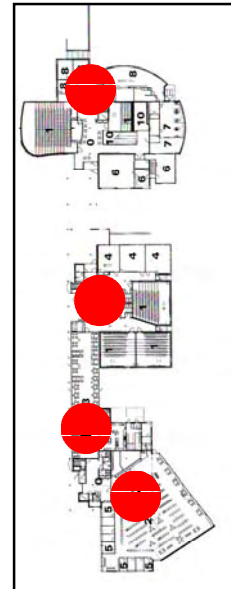
Stop 3, The library
Perception of the library is very positive, it is perceived as a bright, airy and well organized room. It is seen as user friendly, with sitting places and related offices. The library is pointed out as perhaps the best room in the building. Negative experiences related to the library are primarily related to circumstances of building physical character, such as draft from the door between the main door and the expedition area. The entrance of the library is perceived as narrow, and the expedition is mentioned as the area of the library that could be organized differently. In the proposal of improvements many users wish a service point. This is connected to the impression of the library as the real main entrance of the compound.

Stop 4, The group rooms, reading room
Users see the reading room as a spacious and open area. They are also satisfied with big group rooms in relation to the reading room, but comment on the lack of purpose for the small group rooms. Many wish these rebuilt as larger group rooms. There is also a problem with the entrance to the group rooms being directly from the reading room. The doors make noise. Many users also wish a direct access between the reading room and the library.

Stop 5, The teacher offices, administration
The corridor into the teachers` offices is seen as narrow and confined. Glass walls between corridor and offices are a positive aspect, but this does not help much with window shades blocking the light. The corridor is too small for it to be an active addition of area to the offices. Users are unanimous in their suggestions towards removal of the double corridor.

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[22] *The users in this context were representatives of the students, educational personnel, maintenance personnel and administration.*

Stop 6, The music section
The music section is being described as a good section with a fine music room, good lighting conditions and a great view. The fact that everything is located in one place is also positive. Negative criticism is mainly related to the size of the area in accordance to the number of users. Some suggestions for improvement focus on the repair of ventilation system.
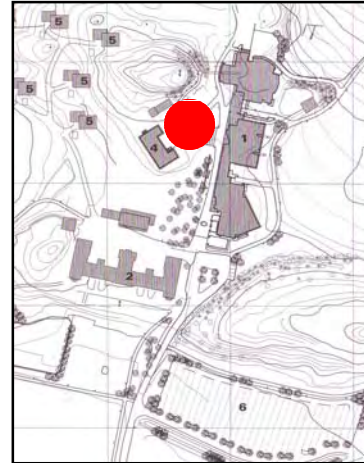
Stop 7, The Nursing Department
Great architecture, bright and enjoyable with a good view is the characteristics used about the nursing department. This is experienced as a user friendly section, with good contact to supporting areas. There are negative impressions related to the area of this section being too small for the number of students using it. Concrete walls in the hall are also experienced as grey and sad.

Stop 8, Nylåna, campus
Nylåna is situated in pretty, natural surroundings. Users have a positive attitude to Nylåna. They characterize Nylåna as a handsome building with fine architecture, and it is a building they are proud of. The lack of a clear main entrance to the building is mentioned as a negative aspect. Having the main air intake by the entrance has proven to be problematic, according to smokers. These have now been banished to other places on the area. For people with reduced walking capabilities, as well as wheelchair users, the cobblestone pavement is disadvantageous.

7.1.2 Comments on the findings

Information about the users' age and sex has been gathered. This information can only to a small extent be associated with the users` attitudes towards, and experience of, the building. Those who have used the buildings most frequently and over the longest period of time have the most comments. The disabled user is the one who mostly emphasizes accessibility.

After the walk-through, the results from three stops were summarized in plenary. In the assessment of suitability for use, the users arrived at following factors being central; functionality, building physics, architecture, management and productivity.

The discussion after the walk-through showed that the users had increased their understanding of usability, and also added management and productivity to the list of factors being important. A second walk-through with the same participants would probably been focusing more on how the space supports the different teaching activities in Nylåna.

7.2 Findings from interviews

7.2.1 General

The findings from the interviews give a good impression of the usability of the building seen from the perspective of 4 different users representing 4 different roles and point of view. In general we find that the users interviewed are quite satisfied with the building. *"The students are having a great place to study with lots of data rooms, library and canteen."* Surveys made on a national scale also show that the students perceive the university college at Røstad as an attracting place to study.

Still there are several comments on things there are not so good, and it seems to be small differences in the answers from the interviewees.

Impressions of the building
The interviews show that there are different opinions about the architecture and the impression of the building. The project "Nylåna" is different from all the other buildings at Campus that are from the original old farm and firmer special school. "*The first impression is chaotic. Some parts are beautiful, others are dreadful. This comes both inside and outside*" says one of the students." Others think Nylåna is a modern and fine building, reflecting our time and values. This was also an important and big discussion in the jury of the architectural competition.

Access
There is a good access to the campus with official transportation. Next to Campus there is a bus stop, and the railway also stops at Røstad. A footbridge from Levanger has newly been established. At the start there was a lack of parking area. The parking lot has newly been extended. It is not allowed to park outside the buildings at Campus. Parking made for delivery of equipment is lacking. Goods transport is being made at the east side of the building. The access is steep and can be icy in the winter.

The surface outside Nylåna is covered with paving stone. It is nice looking at, but hard to handle for disabled.

Orientation
A sign at the parking lot gives the visitors an overview of the area. The main entrance is invisible for people arriving to the building, and is not working as intended. Another entrance in the south part of the building is mainly being used. It is also a problem that the University College's reception is in another building.

"Nylåna" is difficult to understand for new users, such as visitors, new students, and part-time teachers. Both students and employees find it difficult to locate rooms when their only identification is a line of numbers on the doors. The signs are also difficult to locate.

The canteen
The canteen is working well on a daily basis, and students use the canteen for studies. Students miss a place in the canteen where entertainment can take place. It is a problem that the canteens kitchen is too small to be able to serve bigger events. The kitchen was planned to deliver small and simple dishes, and cooperate with the student unions external canteen. But on a daily basis this is not working.

On the ground floor the canteen is the only passage between the main entrance and the rest of the building. Some look at this in a positive way, as it generates activity in the canteen. Others look at it as negative, generating traffic through the canteen. Another problem is that people using the southern entrance *"enter the building full of rain or snow. Walking through the canteen they shake off the water from their jackets"*

The library and the reading room
The library is looked upon as a well functioning and beautiful area. The place for reading in the library is in lack of shielding. The library ought to be together with the reading room that is not very attractive as is it now. Students do not want to use the reading room. The rooms for group activities are compared with prisons cells, being cold, sterile and having small windows. There are plans for reorganizing the reading room, and include that space with the library to be more of an information working place.

Auditorium, group rooms
Nylåna was planned for teaching larger groups of students in auditoriums, and topics like music, nursing i.a. in special rooms. Students perceive the auditoriums as nice but claustrophobic because they lack windows. During the past years, the number of students has increased and the way of teaching has changed. This has resulted in a lack of group and seminar rooms.

Locker room
The students miss locker rooms. They also miss a cloakroom connected to arrangements.

7.2.2 Effectiveness

Most of the comments here are on lack of space, mainly due to the increase in number of students. The shortage of rooms is a problem for planning different activities, and special ad hoc activities can be very difficult to be carried out. *"Distributing rooms is a real puzzle".* Pedagogic principles and ideology has changed from teaching given in auditoriums to problem based teaching. There is therefore a lack of adequate space for teaching in smaller groups.

The interviews show that problems and new needs are taken care of, and tried do be solved. *"The building has become more and more functional. We have got a cashpoint, the library is working well. The music section is having too many students, but they are getting their work done.*

Surveys made on a national scale shows that the students perceive the university college at Røstad as an attracting place to study."

Supporting educational processes
The building supports the ongoing educational processes. Students miss space for exposing the lines of study. The music rooms give the wanted efficiency, but are used by a lot more students than originally intended. This gives a lack of air quality. The music department also miss rooms for group activities. Because of few rooms, training small groups of students most be spread out and takes a long time. Functionality is at place when the groups are small enough.

Obstacles for efficiency
The lack of space is an obstacle for performing the desired activities. The distribution of rooms is working well, but there is no space for ad hoc activities. In the nurse training section the overall area is too small, and the audition rooms are too small. There is also a need for area for workshops (seminar) both in the nurse training section and in general. The auditoriums are not usable for those activities and have become expensive rooms with a low degree of use.

The project is planned without social and informal space for the educational staff. They are meant to eat together with the students. This does not work as intended. The nurse training staff is using the old canteen located in another building at Campus. "*If it has a purpose students and educational staff can eat together, but it doesn't work as a social event."*

Cooperation with other departments of study
The departments of study have very different cultures. There is little cooperation between them. The nurse training section cooperates with the nurse training at the University College in Namsos. The possibilities for interdisciplinary cooperation has not been utilized, but *"the limitations are first of all a matter of thinking".*

7.2.3 Efficiency

Capacity of rooms, airing, aesthetics and access are critical criteria for a well working university college.

Capacity
From the programming phase to completion of the project, the number of office posts have increased from 123 to 189. In the completed building there are about 70 offices for the staff, so it was already from the beginning a lack of space for the staff. After completing a new building, "Nordlåna" this problem is solved.

The number of students has increased by 1000 from 1500 to 2500 since the campus was completed. *"The agglomeration of buildings is producing almost 100% more students than they were planned for".* A widening of the teaching period from 2pm till 4pm covered the need for teaching area. *"By extending the teaching period the number of students could have been even higher."* But teaching in the afternoon is problematic because several students also are parents with small children.

The use of space
The rooms have a high degree of use, all though some rooms are less in use than they ought to be. The group rooms connected to the reading room is not being used. The students do not want to be there. There could have been fewer auditoriums and less reading rooms. Instead there could have been more group (seminar) rooms, and flexible teaching rooms.

The offices for the educational staff are divided from the students' area with a double corridor. The distribution of rooms is being managed through a program called "Novachem". All who have access to the intranet can see and book rooms by sending an e-mail to the administration.

Category of area missing
The informal meeting space is missing in the project. Locker rooms for the students are also missing.

Equipment / technology
This is quite a new building, and overall the equipment is satisfactory. The music section doesn't have enough equipment. The nurse training section got a lot of new equipment when they moved to "Nylåna". Washstands are missing several places, for example in the nurse training auditorium. It has been a problem to avoid theft, and a locking system has been established.

Operation, maintenance
Today the responsibility for the operation and maintenance of the building is divided between Statsbygg and HiNT. The buildings owner, Statsbygg, is responsible for the operation. The university college wish to move the daily activities over from Statsbygg to the university college so the administration of FM, communication and the response to the users will be easier. After 5-6 years, there are still some technical things that are missing; admission control, regulation for level VHA day and night, control system for ventilation etc.

Physical changes, flexibility
There have been several changes in Nylåna since the completion in 1999;
- A system for controlling ventilation has been established.
- The kitchen in the canteen has been extended.
- A few rooms have changed its functions. One office is in use as a meeting room. One office is a social meeting place. One group room is in use as an office.
- There has been added colour to walls.
- Oak three in the stairway has been replaced with ceramic tile.

There is great cost connected to changes in the project. *"Concrete walls aren't flexible".* But several changes have easily been made because there are many general rooms that can adapt to new use.

7.2.4 User satisfaction

One of the main element of the usability concept, is users satisfaction with the building. In the interviews we asked about satisfaction connected to different topics like workplace, indoor climate, image, and service, operation and maintenance. An overall response is that *"Nylåna is nice and friendly. The students are having a great place to study with lots of data rooms, library and canteen."*

But with buildings noting is perfect, and there will allways be some people who are critical. This said, dissatisfaction levels are low. The comments on things that do not work are;

Ventilation
The lack of ventilation / airing is one of the major problems at the music section and in some other rooms. This is mainly due to two aspects; too many students in rooms planned for smaller groups, and that the system has not been correctly adjusted after completion.

Light
Some rooms have well working daylight. Other rooms have no daylight at all. Students also make complaints about the temperature of light. The sun shield is working well, besides some mechanical problems.

Temperature
The temperature can not be regulated by the students. Some rooms are a little hot. Other rooms, such as the meeting room connected to the music section, is cold. The opening windows are small and difficult to reach. They do not contribute to air circulation when opened. The regulation of temperature has a slow response to changing outdoor temperature.

Acoustics
The acoustics is perceived as well working.

Aesthetics
The opinions vary from very nice to grey and boring.

Access control
There have been several problems connected to the locking system. Users have been unable to unlock doors. The alarm has been activated.

7.3 User survey

The aim was to study how well Nylåna worked from the users' point of view to help learn lessons on usability for future design and management. The results of the questionnaire were very positive. Building Use Studies Ltd[23] has in their summary report (Ref. Attachment B) written the following;
"The results were exceptional. When compared with the UK dataset (there being no comparable Norwegian dataset for benchmarking purposes) the building came in the top 3% of the dataset using a wide range of user performance criteria.
The main lesson to be learned was that good usability in buildings depends on robust performance on basic factors like comfort and space provision, with design and management factors equally contributing. Aesthetic factors tend to be secondary. Users pay much more attention to how the building supports the work that they are carrying out. If the basics are in place, as they were here, then other factors tend to follow, creating a virtuous circle. As such, this building was a model example."

The most important findings in the report are presented here;

7.3.1 How well does Nylåna perform overall?

The report shows some very positive results; *"Using data from the staff survey, we rate the building as excellent".* Another calculating method, the BUS Summary Index, puts the building in the top 3% of Building Use Studies Ltd's benchmark dataset (based on UK buildings). This is an exceptional result. The ratings from the students' survey are slightly lower than for staff, but it still rates excellent.

7.3.2 The overall context

Is the building comfortable enough?
This is an extremely comfortable building. There are complaints that it is too cold and possibly too dry in winter, and there is some reported summertime discomfort. Students are more concerned about comfort than staff, possibly because most staff have their own offices and have better personal control.

Are space requirements being set?
Responses to the questions about space in the building and space at desk show that there are no serious problems here. However, some teaching rooms may be too small, especially for groups.

Any other contextual features where the building is failing?
One possible area of concern is signposting and way finding. Several comments bring up this including unclear signposting for visitors, and lack of staff names on doors, making it difficult for the students and others to locate staff.

Perceived health and productivity
We have also asked occupants for their perceptions of how their health and productivity at work are affected by the conditions in the building. As we might expect from the other ratings, both are good scores for both staff and students.

7.3.3 Opportunities for intervention

Levels of perceived control are reported to be quite low even amongst staff with their own offices. Because ambient conditions are generally good this is not an issue. Except for lighting, levels of perceived control (over heating, cooling, ventilation and noise) are lower amongst students than for staff, as would be expected when the students are working mostly in an open library environment.

The results for lighting are particularly good, both for control and for perceptions of lighting overall. Not surprisingly, staff has more control over lighting than students. There may be some cases where light switches are not labelled clearly.

One area of concern is the security locking system which staff report as being difficult to use. For example, they say that there may be circumstances in the event of, for example, fire where staff may find themselves locked in and require help from outside to be released.

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[23] Leaman, A., *Building Use Studies Ltd.*

7.3.4 Individual users' everyday experience

Much of the feedback is positive. Inevitably there are areas of concern. These are the most noteworthy points from the staff;

- The electronic locking system does not work properly, with several side effects including prevention of access to music rooms at weekends and perceived danger that people may be inadvertently locked in.
- Some internal circulation does not work well, including e.g. the number of fire doors in staircases, and poor student access to upstairs reading rooms where they have to leave the building to reach them.
- Poor signposting for visitors, and difficulties with way finding generally, including lack of welcoming signs.
- Lack of views out from the auditorium.
- Some concern about the design of the canteen, especially circulation patterns and its use at peak times.
- Exhibition spaces could be improved.
- Some of the educational rooms are too small, and do not work well with groups.
- Some staff are affected by glare, but this is not widespread.

From students, these are the most noteworthy points;

- Lecture halls and group teaching rooms can be too small
- Lack of storage for winter clothes
- Too cold in winter in the library
- Circulation and movement problems in the canteen
- Room entrances get crowded
- Absence of wireless computer network
- Tables in the auditorium are too small, and some desks may also be lacking knee room
- Glare from sun is reported in the auditorium.

7.3.5 Main points

The building has many of the features which occupants love, e.g. ventilation with reasonably good user control, individual offices for staff, well-balanced and comfortable ambient conditions, especially in summer, and noise-free for the most part.

The building seems to meet most of the needs of the occupants quite well, although there may be growing capacity problems in if student usage grows.

The one negative factor that we could point to is the security locking system. Users seem to be frightened of it, especially that they may be locked in if there is a fire. The locking system also discourages weekend use, for which there seems to be some demand.

This is a classic lesson on building usability. Very simplified we ca say that if the basics such as comfort, space provision and controllability are well designed and properly in place as they are for the most part here, then usability and manageability usually follow, and users will be happy.

7.4 Summing up

Surveys made on a national scale show that the students perceive the university college at Røstad as an attracting place to study.

This case study shows that in general the building gives a high degree of usability, but there are also several areas of improvements. The users involved in the workshop, walk-through and interviews had a reflected opinion on both positive and negative aspects of the usability of Nylåna. The students tend to give lower ratings for most variables than the staff. Even so, the building makes an exceptional high score in the user survey in comparison with the UK benchmarks.

7.4.1 User satisfaction

The location and the site for HiNT Røstad give a campus with buildings in a beautiful nature landscape. Users have a positive attitude to Nylåna. In general we find that the users are quite satisfied with the building. They characterize Nylåna as a handsome building with fine architecture. A building they are proud of.

There are very different opinions about the design and the use of materials, colours etc, from very modern and stylish, to very unfamiliar and cold.

The comfort is in general satisfactory concerning temperature, air, noise and lighting, but there are complains on ventilation in some of the rooms. That is mainly for the music section. There is also complains on the temperature in winter in some parts of the building (canteen, library).

Another problem is the access to, the orientation and the way finding in the building. The main entrance does not function as intended, and people can have some difficulties to find the different rooms because of a complicated and unclear signposting.

We find that the users are very satisfied with the operation and the maintenance of the building, and that the staff responds to their problems. The building has become more and more functional being adjusted to the needs. But still there is a problem with the ventilation and the controlling of the ventilation in some parts of the building, 5-6 years after completion.

7.4.2 Efficiency

Effectiveness is about doing things right, being productive, having the space, equipments and the support needed. The results from the case study give indicates that the building in a high degree support the activities. The number of students has increased by 1000 from 1500 to 2500 since the campus was completed. The University College has been able to meet this increase by using the building more intensive and by a widening of the teaching period in the afternoon. But still there is a lack of smaller room, places for informal meetings and ad hoc activities. We see that some of the problems regarding the ventilation / airing are caused by overcrowded rooms originally planned for small groups. The lack of offices for the staff was solved when the Nordlåna building recently was completed.

7.4.3 Effectiveness

Efficiency is about doing the right things and must be related to the strategic level of the organisation. The results from the case study show that there has been a change in educational thinking from teaching in an auditorium setting, towards more project and problem based work in smaller student groups. There is now need for more group and seminar rooms, and less need for the big auditoriums. Together with the increase of students, this has been a challenge for HiNT. Some of the new needs have been solved by transforming room and overloading existing facilities. But it is much more difficult and expansive to transform auditorium into smaller rooms. The problem can also be solved by moving out one of the departments, allowing the others to grow.

One wanted effect of relocation of the three departments was to create synergies by getting more professional and social interaction between the departments, and between staff and students. This has yet not happened. The different departments work as independent and self-sufficient units. This is partly a cultural thing, and partly due to the fact there are few possibilities for formal / informal meeting places in the building.

8 DISCUSSION AND SUMMING UP THE CASE STUDY

In this case study we wanted to study the aspects of usability mainly from the users' perspectives, i.a. from the staff and the students' perspectives. We also wanted to use different methods both to see what information we can get out of them, and to develop the methods further.

8.1 What does usability mean, and how can we understand the concept?

According to the ISO definition, usability is defined as the "*effectiveness, efficiency and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment*" [24].

According to A. Leaman[25], people seem to think of usability only in terms of users' interaction with objects like chairs and devices like switches and blinds. We also have to include the overall ambient context and opportunities for intervention. This makes up the total usability experience including assessments of functionality and aesthetics.

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[24] International Standards Organization. *ISO9241-11, Ergonomics of human system interaction.*
[25] Leaman, A., *Usable Buildings. Building Use Studies © 2005.*

In the preparation for the workshop and walk-through we wanted to get the users understanding of usability without presenting our more "academic" approach. The users were asked to point out which key factors they meant were relevant and essential for the building being suitable for a teaching and working place. Not surprisingly, the users gave quite different answers, reflecting their focus and experiences with the building. All together the answers more and less covered all the three aspects of usability according to the ISO definition, without being very detailed and exhausted. After the walk-through we had a reflection on the content of the usability concept, where the participants came up with several more nuanced aspects of usability.

Our case study and earlier discussions, both in the CIB TG51 and at our own faculty, shows the difficulty of having a clear understanding of the usability concept. This becomes even worse when we try to translate this system of concept into Norwegian. In accordance with Jensen[26] the English language in a better way than many others distinguishes between nuances within the usability term. In this way *efficiency* means "to do things better", while *effectivity* means "to do better things". The Norwegian vocabulary does not permit describing the difference in these terms, and the word "effektivitet" is a common denominator for both. Due to this, the above described differentiation is lost, and it is an extensive need to define and describe the different terms and the connection between them, to gain a better understanding of the meaning and significance of the terms. This was the background for an internal workshop at NTNU[27]. Researchers and academics tried to develop a common understanding of the term "usability", to define the content and different aspects of the term, to discuss the most important criterions for usability, and methods and tools relevant for measuring this aspect of a building. The result from this workshop was a first outline for a usability framework. Here we also conclude that usability should be related to both organisation, technology and space.

A good system of concepts is necessary to ask the right questions and get the right answers. When we see the summing up from the interviews, the language still is too vague giving good place for interpretation.

The question of what usability means, and how we can understand the concept is also very essential in the design of a questionnaire exploring usability. This is directly related to the question of indicators and how we can measure usability in a certain building for a particular organisation at a specific time. In this case study we used a questionnaire developed by Building Use Studies, used in many studies in the UK. We were assessing how building users perceive how the building works, especially in the way it enables them to carry out their work effectively.

The case studies carried out in the CIB TG51 gives a good platform both to discuss the usability concept, and learn from the different projects what the experiences of buildings in use are. It is not so difficult to see the benefit of evaluating buildings from a usability perspective to detect and improve the workplace and building for an organisation.

Another discussion is how we can take this experience, learning and understanding from the usability concept into the planning process for a new building where we are focused on and familiar with the functionality concept. Will this bring something new into the planning process that will improve the value and the usability for the futures users?

8.2 Is usability depending on context and perspective?

The Swedish case study and report argued that the usability concept was depending on the context a building is designed and used in, and the values og the designers and users. On a general level it can be difficult to define exactly what gives an organisation usable buildings because both context and values change with time and place. What gives a high degree of usability for one organisation, does not necessarily have general application.

In the Norwegian case we see there are some important conditions that influence on the usability. First of all we have the program for the architectural competition, giving some guidelines for the master plan and the design. The competition gave different answers on how the design and layout should be, giving different opportunities and barriers. One of the arguments for choosing this concept was the opportunity to gather three different departments in one building.

Another premise for the project was the total space budget and the investment budget for the building, giving a framework for developing the project.

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[26] Jensen, P., A., *Håndbog i Facilities Management*.
[27] Hansen, G., *Usability of workplaces. Innhold, begreper, kriterier. Workshop 18. mai 2004.*

We also see that the cultural aspects play an important role in the project. The deanery wanted that the relocation of the three departments in the new building, Nylåna, should give a synergy effect of more professional and social collaboration between the occupants. Even there is a lack of space for informal meetings in Nylåna, most of the barriers are in the head of the people using the building. It seems that the departments are quite satisfied with a situation where they have a more internal focus.

In this report we find that usability is depending on the different stakeholders' perspective. Both the walk-through, interviews and survey clearly state that there are different opinions on the usability of the buildings seen from the students, teachers, administration or the maintenance staff´s point of view.

The findings also show a difference in which factors that are important for the different users, and that the users is mainly concerned about the space they use regularly and are not so concerned about the building as a whole. A reason for why the students like the building less than the staff can be explained in the fact that the students use the whole building in study, while the staff only uses parts of the building.

We also can assume that the persons responsible for the operation and maintenance of the building have another relation to the building. They often have their office and workplace some other place, and will be more concerned about accessibility to the different technical systems, cleaning, security, maintenance. From the students and the staffs' perspective, it will be essential that the technical staff understand the users needs to support their activities.

8.3 Do the different methods give the right answers?

The workshop, including the walk-through, is a very simple and fast way to get the first overview and indications of the usability of the building. The participants did a homework for preparation to the workshop, where they could think through the content and meaning of the usability concept.

The walk-through started with a reflection on the usability concept. The intention of that was to look at the building with a keen eye. In this case the participants had to write down positive and negative impressions, and suggest improvements for the different stops along the route. The success of using walk-through is highly dependent on who is participating. We find that different people have different perspectives, experiences and focus. In our walk-through we had representing teachers, administration staff, students and persons from operating and maintenance that should cover a wide range from technical aspects to accessibility, functionality, and user satisfaction. The walk-through has a visual approach to evaluate the building, and the findings show that the focus is on space, architecture, indoor climate and accessibility. One of the participants had a little handicap that gave more information about aspects important to accessibility. Another person studying music had a lot of information and attention about that department. The same with one of the teachers from the nursing education department, when we stopped at their place. Users doing evaluation on usability will naturally relate their experiences to their opinions about the building, while an expert will relate more to a general knowledge about building and use.

The results from the walk-through and the quality of the evaluation will depend on who is participating, the preparations, the route for the walk-through and the focus of the evaluation.

Taking interviews is a qualitative method giving opportunity to go deeper into several aspects of usability and also see the answers in a context which is very important for understanding the results. While the walk-through more was based on the participants opinion of usability, the interviews were more structured. We wanted to use the definition of usability for more systematically focus on effectiveness, efficiency and satisfaction. From this case study, it seems that it is easier to get information about the users' satisfaction and the effectiveness of the building, than findings on the efficiency of the space. There was good accordance between the different interviewees' answers and comments on ventilation, temperature, lack of adequate rooms, common rooms like canteen, library, reading room and main entrance. When we come to efficiency the question of usability seems to be more depending on the different persons' perspective and standing point. What appears as usable and efficient from a students' point of view, does not necessary mean the same for the teachers or for the administration staff. A good solution for the staff can for example mean worse situation for the students concerning availability to the teachers.

The four interviewees had focus on their own department, and responded on questions about usability from that point of view. None of them had an overall perspective related to the University College as a whole, to see the different departments in connection to the rest of the organisation. One reason for this can also be the selection of interviewees. None of them were from the deanery.

The findings from the interviews do not necessary give a representative picture of the usability of the building. What we can see is that the findings from the walk-through are confirmed, and that we get some more detailed information about different aspects. We also get more information about the efficiency and effectiveness of the building.

Very simplified we can say that we get what we ask for from whome we ask. The findings from the interviews will depend on the selection of interviewees and which questions being asked. Here we see a great need for a framework and a vocabulary that support an evaluation on usability.

The survey was carried out as the last part of the case study, and was based on a questionnaire that has been carried out by Adrian Leaman from the Usable Buildings[28] in UK. Using this questionnaire give us the opportunity to benchmark our case study to the UK database. The survey gives a very good picture of the indoor climate of the building, and we find our case study over average for most of the topics. We find that the survey gives some indications about the effectiveness of the building, but it is not specific enough giving information about the efficiency. Perhaps this is also reflecting the difference in culture and focus on different aspect of usability between the Scandinavian countries and UK. In the questionnaire there also was place for comments. Those comments give a broader picture of the different aspects of usability.

If we should develop our own questionnaire, we would have been using criteria developed from the internal workshop on usability at NTNU May 2004. Topics like way of working, need for space, need for technology, flexibility and adaptability would be more central in this survey.

The findings from the survey will depend on the questions asked and the response rate. From this case study we see a need for developing the questionnaire giving more answers regarding the efficiency and effectiveness of the building.

8.4 Does the process give the right result and effect?

An important question in this case study was whether the planning process gives the right result and effect. In the summary of the survey, Leaman[28] pointed out that the main lesson to be learned was that good usability in buildings depends on robust performance on basic factors like comfort and space provision, with design and management factors equally contributing. Aesthetic factors tend to be secondary. Users pay much more attention to how the building supports the work that they are carrying out. If the basics are in place, then the other factors tend to follow.

The results from the case study show that this is a building with many qualities that should support the activities taking place. There are still some work to do, to improve and adjust to the things that have been pointed out as negative and dysfunctional.

We see that the University College has had a significant increase in the number of students. There has also been a change in pedagogic and need for dividing the big classes into smaller groups, with consequences for the use and need for smaller seminar rooms. There have been some minor changes to the building, mainly of technical character and use of space/rooms.

Mainly the building and the use of the building is still the same as it was completed in 1999. Nylåna was intended to give new and improved possibilities for the students and staff. Different departments being together in the same building should create a lot of opportunities for studies across the old branches of study. The case study shows that those intentions still are not fulfilled.

The findings from the interviews with participants from the planning process, and the examining of the procedure for the project, show that there are several things that indicate a connection between the process and the result. The procedures for the project are quite detailed, giving instructions on how to deal with different processes, information, documentation and decision making. Even the fact that those procedures are present, does not necessarily mean that the reality follows the routines or that the results are good if the routines are followed. A good example is the user involvement.

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[28] Leaman, A., *Usable Buildings. Building Use Studies © 2005*

A user group was established, but their mandate was vague and not defined. The group was more reflecting a minimum of democratic representation rather than having the right competence and experience for this work. A competent and supported user group would probably have led to a better program. But we also have to say that the final design of the special rooms in the nursery education section and for the music section seems to be quite successful.

Another aspect that seems to be missing is the involvement from a strategic level in the project throughout the whole process. This is especially important when you come to the two aspects of efficiency and effectiveness for the University College. A strategic discussion would also include a longer time perspective, and questions about future pedagogic principles, flexibility, adaptability etc.

9 RECOMMENDATIONS

This case study shows that there are some areas of improvement to give the users the building that supports the education activities in Nylåna;

Getting the ventilation right
The case study shows a lot of complains to the air quality in some parts of the building. It is necessary to go through the ventilation system to upgrade and to get the control system in order.

Getting the temperature right
Use the central management and control system to register the temperature in the building, and adjust the indoor temperature to the outdoor conditions.

Getting the security locking system right
The electronic locking system does not work properly, with several side effects including prevention of access to e.g. music rooms at weekends. This should be examined further and brought in order.

Making the way finding easier
The case study shows that it is a poor signposting, special for visitors, and difficulties with way finding generally. A better signposting should be established, with an overview of the building placed on strategic places.

Redesigning the reading room
The reading room is not working as intended. It should therefore be redesigned with more attractive group rooms, and an internal connection to the library on the ground floor.

Solving the entrances problem
The case study shows that the planned main entrance to the building is not being used as intended. The entrance to the south will be the natural entrance for people coming from the bus, train or from the parking place. People will naturally take the shortest way in to the building. This is both positive because it generate traffic through the canteen, but also negative for the same reasons. Locating the information and service point close to this entrance, the library and the canteen will strengthen that behaviour. Another strategy is to redesign the main entrance hall, and see the entrance hall and the canteen as an attractive and social meeting place. Locating the information and service point here will strengthen this part of the building as an important place. There is also a need to do the outdoor signposting better, so the people will be guided to and chose this entrance.

Establishing an information and service point
Originally this was located close to the library, but was moved to another building. The interviews and walk-through indicates a need for an information and service point for the students placed in Nylåna. One suggestion is to locale this near the library and canteen at the south end entrance (the first place you come to when you arrive the building).

Making a strategy for further development
The case study shows rather major changes in the number of students at Campus in general, and particularly in Nylåna. We also see changes in the pedagogic principles for learning and teaching, both within and across the different departments. This will influence on the potential use of Nylåna, particular regarding the use of the auditoriums and need for group and seminar rooms. It is necessary to make a strategy for the further development of the campus.

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Attachment A

USABILITY – THEORETICAL FRAMEWORK

Based on the four case studies already carried out by the CIB Task Group, we have seen the need for a stronger theoretical framework for understanding and exploring the concept usability of buildings. This has been the basis for our case study, as well as being a possible platform for developing a method or an applied guideline for evaluating usability of buildings.

Usability is defined as the "*effectiveness, efficiency and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment*"[29].

According to this ISO-definition, a product's usability is determined by 3 key factors:
Effectiveness – whether users can achieve what they want to do with the product
Efficiency – how long it takes them to achieve it
Satisfaction – their feelings and attitude towards the product

In accordance with Jensen[30] the English language in a better way than many others distinguishes between nuances within the usability term. In this way *efficiency* means "to do things better", while *effectivity* means "to do better things". The Norwegian vocabulary does not permit describing the difference in these terms, and the word "effektivitet" is a common denominator for both. Due to this, the above described differentiation is lost, and it is an extensive need to define and describe the different terms and the connection between them, to gain a better understanding of the meaning and significance of the terms.

Usability means that systems are easy and fast to learn, efficient to use, easy to remember, allow rapid recovery from errors and offer a high degree of user satisfaction. It also means bringing the user perspective into focus.

The concept usability of buildings can be approached in four ways;
1. Usability from different stakeholder's point of view
2. The time perspective
3. Workplace and context
4. Criterions and parameters affecting usability

Usability from different stakeholder's point of view

Different stakeholders and organizational levels have different perspectives considering usability of buildings. The terms usability, effectiveness, efficiency and satisfaction is interpreted and understood in different ways. Productivity and effectiveness are generally emphasized as a strategic management issue, while individual workers are engaged with user satisfaction and practical aspects in their daily working situation. There are several ways to divide an organization into levels. We are proposing a classification in five levels, ranging from the company in total to the individual workstation;
- The company
- The Facilities Management (FM)/ property
- The project / department / division
- The team
- The individual workstation

The four international case studies have made use of different approaches to the stakeholder perspective, and have been limited to different stakeholder's point of view. While the British case study is focusing usability related to teams and individual workstations, the Finnish case study is studying the main areas in the building and the usability perspective from the FM / property and project point of view. The French case study is discussing usability according to the company in total, FM / property and project / division.

In this case study we have been focusing usability from the user perspective, and have been emphasizing the perspectives of the staff and the students. The results of the case study confirm that different users have different opinions due to usability of buildings, and that the students in general have other criteria for usability than the staff.

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[29] International Standards Organization. *ISO9241-11, Ergonomics of human system interaction.*
[30] Jensen, P., A., *Håndbog i Facilities Management.*

The time perspective

The second approach to the concept of usability is discussing the time perspective in a building process. It is useful considering the different phases of the building process, and to discuss how the usability perspective is changing during these phases.

Development of concepts   **Production**

| objectives / framework | concept, design | detailed project | building, production | Facilities Management |
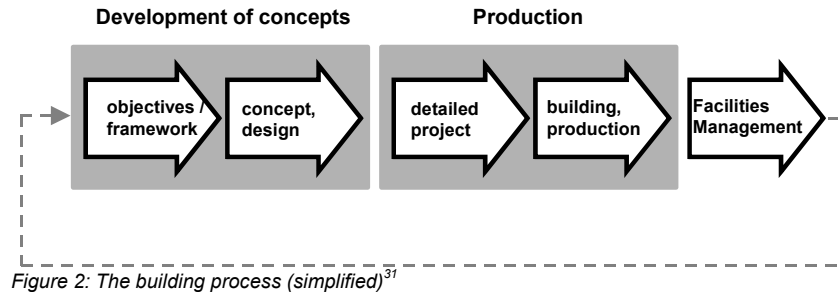
Figure 2: The building process (simplified)[31]

The perspective on usability changes during the building process due to the character of the tasks and work performed by the different actors (figure 2). The functional qualities of a building are emphasized in the early planning phase, and there is a general focus of technical structures and functionality. In later phases, when the building is almost completed, usability and the user perspective come into focus. This is also visualized in the Ishikawa diagram below (figure 4), where the tail of the "fish" is emphasizing the qualities related to the building, while the head of the "fish" is visualizing qualities related to use of the building.
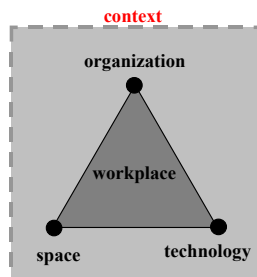
Neither of the international case studies have so far offered much attention to the time perspective due to usability, nor have they discussed how the concept of usability is changing during the different phases of the building process.

Another aspect not offered much attention is the perspective of change over a time period, and adaptability and functionality according to this. The term adaptability means functionality of buildings in a life time perspective. Functionality over a time period is assuming buildings being adaptable towards continual changes in user demands and needs, and new ways of using the building.
In accordance with Blakstad[32] adaptability is described as "*the ability to change as a result of internal or external influence, and is regarded as a strategic "from the top" approach.* The term *physical adaptability* is used concerning the structure and technical system of the building. Adaptability is a generic term for the aspects flexibility, generality and elasticity [33].

Workspace and context

The traditional CIB approach has been focusing architecture and buildings according to technical and structural aspects. The usability initiative has however shifted the emphasis to aspects concerning the organization and user.

"The Knowledge Workplace" project is studying the relationship between the use of space, organizational aspects and information and communication technology (ICT) at the workplace. In her book "Workspace"[34], Mosbech similarly describes *"the four elements of balance"*; organization, workplace, ICT and knowledge, and how these elements must be in balance for an office environment to function optimally.

The triangular figure (figure 3), developed as part of "The Knowledge Workplace" project, is here supplemented by adding context as an aspect in the figure.
This is done to discuss the three aspects space, organization and technology in a contextual situation, to include the setting of a building and to encompass cultural differences in different countries.

Figure 3: The balancing elements of a workplace in a contextual situation.

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[31] Haugen, T., *Samspillet i byggeprosessen 1996 - 1999. Sluttrapport.*
[32] Blakstad, S., *A Strategic Approach to Adaptability in Office Buildings.*
[33] Arge, K., Landstad, K., *Generalitet, fleksibilitet og elastisitet i bygninger.*
[34] Mosbech, K., *Workspace.*

35

Criterions and parameters affecting usability

Several aspects influence a building's usability and whether a building is fit for a specific purpose. At an internal workshop at NTNU[35], researchers and academics tried to develop a common understanding of the term "usability", to define the content and different aspects of the term, to discuss the most important criterions for usability and methods and tools relevant for measuring this aspect of a building. As a common understanding, the term usability describes whether or not a product is fit for a specific purpose[36]. Usability, or functionality in use, is concerning the buildings ability of supporting the user organizations economical and professional objectives. The quality of use for a building means that it is efficient in use (use of resources, productivity, effectiveness, rationality), offer the desired effect in use (increasing the value), and to offer the desired quality in use (user satisfaction).

The Ishikawa-diagram[37] in figure 4, a result from the workshop, is visualizing a simplified picture of this reality.
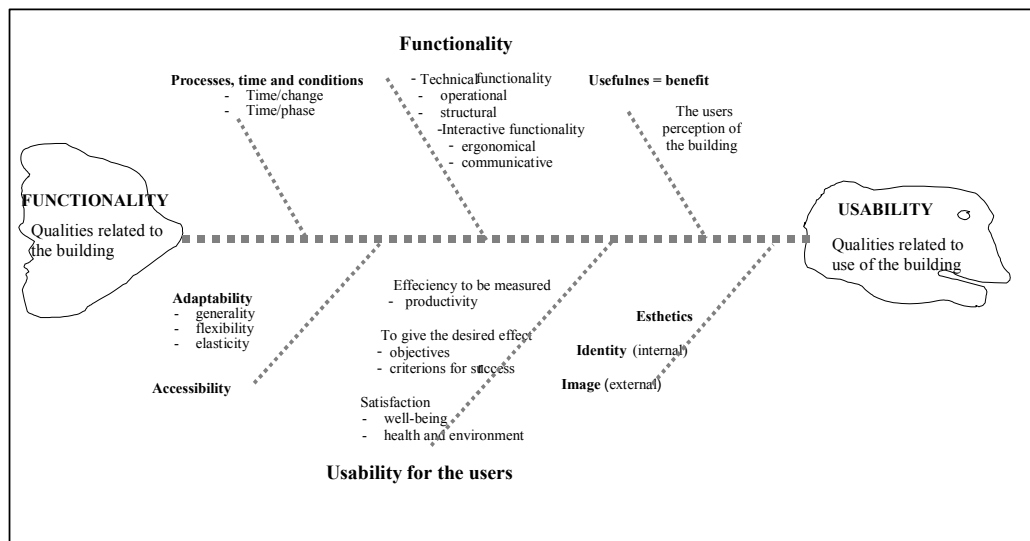
Figure 4: Ishikawa diagram. Criterions and parameters affecting usability of buildings.

The four international case studies accomplished as a part of the work in CIB TG 51 have given various contributions to the theoretical framework and the discussion related to terms and definitions.

The British case study[38] was investigating the concept of usability by discussing the terms usefulness, adaptability, flexibility, functionality that is used, accessibility and ease of use, and their contribution to achieving usability, in terms of efficiency, effectiveness and satisfaction. The workplace needs is defined by studying culture, organization, communication, collaboration, work processes, innovation, learning, attract and retain, technology, change management and trust.

Serviceability – the supply perspective of the building
Usability focuses on user perceptions of the ease and efficiency with which they can use the building. Serviceability, on the other hand, describes the capability of a building to provide a range of performances for which it is designed, used or required to be used, over time. While usability states a demand perspective, serviceability states a supply perspective[39].

In accordance with Davis and Ventre[40] the term *performance* describes the performed service in a particular situation, context and time, while serviceability means whether the building is capable of offering satisfying functionality for the users. According to Granath[41], Davis defines serviceability as a

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[35] Hansen, G., *Usability of workplaces. Innhold, begreper, kriterier. Workshop 18. mai 2004.*
[36] Arge, K., *Forprosjekt – effektiv bruk av arealer. Note.*
[37] Hansen, G., *Usability of workplaces. Innhold, begreper, kriterier. Workshop 18. mai 2004.*
[38] Alexander et al., *Case study: NCR, Discovery Centre, Dundee. Draft report. CIB Task group 51, Usability of workplaces.*
[39] Alexander et al., *Usable workplaces.*
[40] Davis, G., Ventre, F., T., *Performance of buildings and serviceability of facilities.*
[41] Granath, J., Å., *Note concerning usability of buildings, written for the usability workshop in Turku, April 2004.*

broader term than performance, which indicates that his interpretation of satisfaction has a general meaning, and is not connected to individual values dependent on situation, context and time.

Granath also says "*The characteristics of the concept serviceability, as it is defined by Davis et al., (...) is that serviceability and hence performance is causally tied to functionality. In Davis' reasoning serviceability is synonymous to usability in the meaning it has in ISO 9241 – 11."*

Serviceable buildings are buildings of a long lasting technical, functional and economical life time. Buildings functional and economical life time is usually shorter than their technical life time. High adaptability (generality, flexibility and elasticity) contributes, according to Arge and Landstad[42], to prolong buildings functional and economical lifetime, and hence buildings *serviceability.*

This shows that a buildings performance means the service offered in a specific situation, context and time. A building's serviceability describes whether the building is capable of functioning as necessary, and is reflecting the user satisfaction.

Functionality – might result in usability?
In the Swedish case, functionality is discussed as a category beneath usability. According to Warell [43] the term functionality can be described as *technical functionality* and *interactive functionality.*
Technical functionality:
- *Operational functionality*; characteristics or qualities of an object causing that a specific action or work can be done
- *Structural functionality*; characteristics of an object causing that the object is functioning as a part of the whole

Interactive functionality defines characteristics of an artifact that interacts with the users of the artifact:
- *Ergonomic functionality*; characteristics of an object functioning together with the users of the object
- *Communicative functionality*; characteristics of an object dealing with how shape and design expresses value and identification.

It is essential to examine the interdependence and connection between the terms usability and functionality. Will functional buildings automatically be usable buildings, or can a building be usable without being functional? In the theoretical framework for the Örebro case study it is said: "*We all know that functionality alone does not make a certain artifact usable. The technical and physical properties of the artifact and its theoretical potential to deliver a certain effect do not automatically make it usable in the real world. As a result of the definition of usability it also depends on the* **context** *the artifact is designed and used in and the* **values** *of the designers and users. Both context and values change with* **time** *and* **place.**" The Swedish case study concludes that "*We can define* **functionality** *as a property given to an artifact in order to create a* **practical effect***. An important effect can be described as* **usability.**"[44].

In accordance to Warell[45], functionality defines whether the product offers functions and features that users need to complete tasks. Usability, on the other hand describes whether these features will be used easily and efficiently during task completion.

Usability, branding and image
The Finnish case study was concerned with "the Old Mill"-building in the context of creating a brand. The brand concept includes usability, and it offers a way to describe the quality of the building; "*The intangible nature of brand includes the usability. (...) The brand can also be used as a framework for classifying the usability – the brand is a concept, a mindset, which have tangible artifacts like logo, slogans, buildings etc.*"[46].

Four elements are introduced as the basics of a real estate brand;
- location
- functionality (includes usability)
- services
- associations and image

[42] Arge, K., Landstad, K., *Generalitet, fleksibilitet og elastisitet i bygninger*.
[43] Warrell, A., *Design Syntactics: A Functional Approach to Visual Product Form. Theory, models and methods*.
[44] Lindahl et al., *Case study: Örebro University hospital: The O-Building. Draft report. CIB Task Group 51, Usability of workplaces*.
[45] Warell, A., *Design Syntactics: A Functional Approach to Visual Product Form. Theory, models and methods*.
[46] Nenonen et al., *Case study: The Old Mill. Draft report. CIB Task Group 51 Usability of workplaces*.

The perspective of change
The French case study was studying the Ruche building as a mean to support organizational change, product development and improvement of the organizations processes. The project is also discussing the necessity of parallel management of the company's human and spatial resources[47].

Summing up this section, a product's usability is according to the ISO-definition determined by the 3 key factors effectiveness, efficiency and satisfaction. The following criteria or objectives can be related to the key factors, summarized in figure 5;

Efficiency		Effectiveness i.e. productivity	Satisfaction i.e. user satisfaction	
Related to organization	**Related to building**	**Added value**	**for employees**	**for customers**
- production time/cost per unit produced (services or products) - development time/cost of new products/ services - time/cost because of interruptions due to changes in the use of area	- operational cost per sqm - sqm per employee - the number of users / sqm / h - hours in use per day/week - time/costs per change in the use of area	- increased innovation - increased productivity - increased flexibility - increased communication - increased learning/ development of knowledge - increased cooperation - a more distinct identity and image	experienced - well-being - efficiency - air quality - lighting conditions - temperature - aesthetical environment - image and identity	experienced - accessibility - image and identity - value of products and services - service quality

Figure 5: Summing up the criterions and parameters affecting usability.[48]

Some branches of the Ishikawa diagram are more comprehensively discussed than others. It is necessary to bring this discussions further forward, especially related to the branches "processes, time and conditions" and "adaptability". The different terms and interdependence between them will be further investigated during a PhD-study at the university.

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[47] Fenker et al., *Case study: Technocentre Renault in Guyancourt: The Building La Ruche. Draft report. CIB Task Group 51 Usability of workplaces.*
[48] Arge, K., *Forprosjekt effektiv bruk av arealer.* Notat i etterkant av workshop 18.05.2004. NBI

Attachment B

"NYLÅNA, HØYSKOLEN I NORD-TRØNDELAG (HiNT), RØSTAD. REPORT OF BUILDING USABILITY SURVEY."

Case study: Örebro University Hospital: The O-building, Sweden

September 2005

CIB Taskgroup 51

USABILITY OF WORKPLACES

Case study: Örebro University Hospital: The O-building

15 September 2005

Chalmers University of Technology
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1   SUMMARY

This is the second workshop of the CIB51 – Usability of Workplaces series. The object is a surgery and radiology building in the University Hospital of Örebro in Sweden. The building was finished in 1997 and is used generally the same way as it was planed. The case-report is based on interviews with management and staff in the medical departments, both those who participated in the design process and those who did not. Interviews are also made with representatives of the Real Estate Department that was in charge of the design process and is now owners and caretakers of the building.

The architectural and usability ambitions with the building were high. The technological level is very high both when it comes to medical processes and from service engineering point of view. The building has got separate installation floors and some rooms are constructed as Faraday's cages not to disturb sensitive medical technology.

The culture of involving staff in design of their workplaces is very old in the County and dates back to early seventies. Also in this project the process of participation has been very ambitious. Despite a number of controversial issues during the design phase the acceptance and satisfaction of the building is today high.

The end of this case report is a discussion on the concept of *Functionality* and *Usability*. To make these concepts operational the experiences from the case is used. By doing this it becomes obvious how aspects of usability can be affected by the organisation of design and the design process itself.

Gothenburg 2005-09-15

Jan Åke Granath   Josefina Hinnersson   Göran A. Lindahl
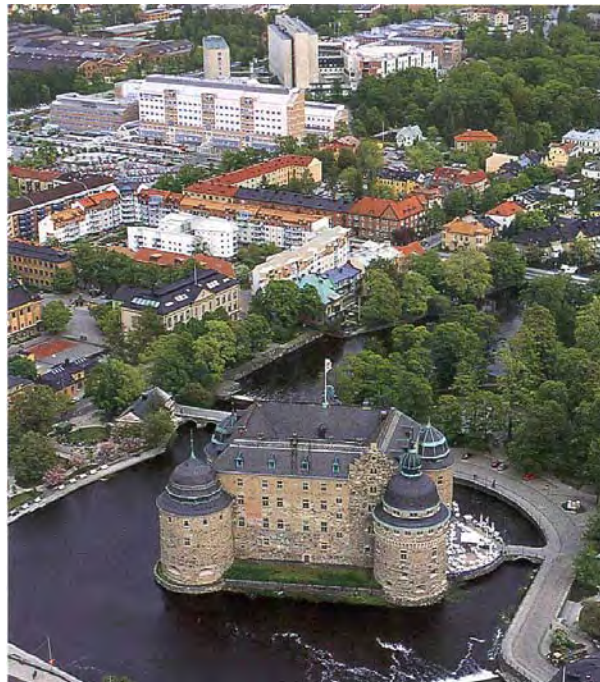
Figure 1. The Castle of Örebro with the University Hospital in the back

2

CONTENT

3

2   ORGANISATION OF SWEDISH PUBLIC HEALTH CARE

Sweden is mainly governed by three administrative levels: The state, County Councils and Municipal Councils. Örebro is the administrative centre of the County of Örebro. The County has 274 000 inhabitants and Örebro is its largest municipality with its 125 000 inhabitants. 85% of the County Council's activities are health and medical care. The County covers an area of 9 700 km^2 which means it is quite thin populated outside the center of the 12 municipalities, of which some are quite small. Every municipality has at least one medical care centre, in all 29.

The largest hospital is Örebro University Hospital (USÖ). USÖ has 3 700 employees and 1100 patients a normal day.

2.1   Purpose

The purpose is to deliver health care and medical services to first of all inhabitants in the county, but also to deliver certain specialized medical care to patients from other parts of Sweden.

2.2   Structure of USÖ

USÖ is divided in eight organisational units:

Cardiac care
Head, skin and oncology
Surgery
Medicine
Rehabilitation
Laboratory medicine
Radiology
Research, development and education

2.3   The competitiveness of USÖ

USÖ is a development-oriented medical centre with patients from many parts of central Sweden. A number of specialist areas have attracted international attention and research is conducted in many fields. There are also extensive basic medical facilities, primarily for the inhabitants of the county. Health care is free for all inhabitants in Sweden except for a minor fee. For patients from other counties their home county will be charged.

USÖ is one of nine University hospitals in Sweden. It is among the leading hospitals in the area of occupational- and environmental medicine, ophthalmic diseases, urology, and cancer treatment. It is one of the leading hospitals in radiology and was the first in the world to link all radiology departments through a shared county network. The European Development Centre for Radiology is located at USÖ.

2.4   External drivers in Swedish health care

Health care is basically free in Sweden. People have the right to get adequate care in their home county. For specialist care they may go to private specialists that are licensed to deliver care. For such medical services the patient is charged a slightly higher fee and the county pays the rest. Under certain circumstances special medical care can be given outside ones own county and also in other countries. If approved by the county, this is also basically free. Patients from other counties are a source of income to the county. When a patient is medically ready different kinds of follow-up-care take place. This is administered and delivered by the municipal councils. This flow of responsibility between private and public, different counties and county and municipal council's responsibilities are important drivers in the organisation of Swedish health care.

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3   ÖREBRO UNIVERSITY HOSPITAL

3.1   History

Health care in Örebro dates back to the fifteens century when it was housed in the local monastery. This ended with The Reformation and was exchanged in 1527 when King Gustav Vasa donated a couple of homesteads for a hospital for the disabled and homeless. Not until 1708 a doctor was employed to take care not only for the County of Örebro but also the nearby County of Västmanland. The first real hospital was established in 1778. It was a county hospital with 24 beds, 16 for patients with "weak heads" and 8 for sick people.

The present Hospital was established in 1892 and has grown at the present location since then. In 2001 the hospital became University Hospital – USÖ.

3.2   The situation today

USÖ is located fairly central in Örebro (fig. 1) and has good communication by public busses. The usable area of the hospital buildings are over 200 000 m^2. The hospital is built over a long time and its olds parts goes back to the original 1892 building. The major development of the hospital was done in 1960:s but an ongoing renovation and investment in new buildings has made USÖ one of the best maintained old hospitals in Sweden today.

The site is located along a small river that makes the environment very pleasant. Especially in the newer buildings the ambition to make pleasant and high quality architecture has been high. Also the outdoor areas are well designed and form small parks and gardens, often connected to the river and the river walk.
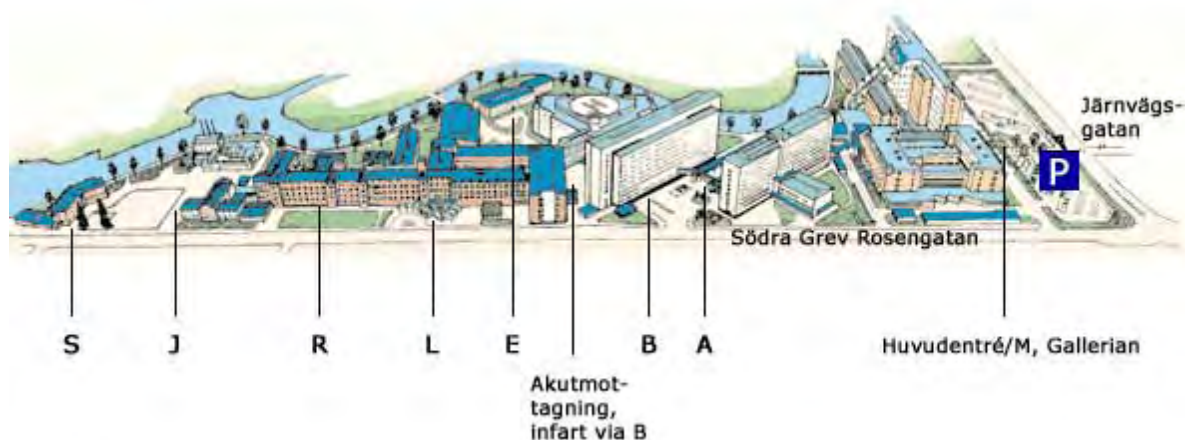

Figure 2. Aerial view of the hospital

3.3   Organisation of real estate and services

In 2001 a new facilities and service company was created – Landstingsservice. The new concept was to include all support to the core business in one organisation. The new company was formed by the following units:

Real estate
Environment
Purchasing
Archiving
Support

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The former Real estate company was now included in the service unit to deliver services in the following areas:

Administrating building projects and act as client
Deliver real estate services
Deliver technical services to the buildings
Administer internal and external leasing of space
Maintain all outdoor spaces

3.4   Property strategy

Like most public health care organisations in Europe, Swedish counties are facing difficulties financing the core business. In many counties this have resulted in low investments in real estate both in terms of new buildings and maintaining old ones. Today when the economic situation is worse than ever many counties have an enormous need for investments in a run down building stock at the same time as the deficit in core business is boosting. In Örebro County the investments have historically been high in real estate. The situation at USÖ is therefore today very positive. The building stock is in a very good condition and the need for investments is not acute.

Figure 3. The main entrance of the hospital

3.5   Relations in a building project

The real estate unit has a long experience as a client and organiser of building projects. Ever since the late sixties the county has established a relationship to consultants and contractors in the region to get as high quality as possible.

3.6   The client and core business relations

Traditionally, health care is organised in a hierarchical way. Building projects however often fall outside the ordinary relations in an organisation. The real estate unit has since early sixties had a very ambitious co-operation between core business and the building project in planning and designing new buildings. From the following case description of the O-building project we find that this participation from core business employee was very detailed and started early enough to affect strategic issues of the building project.

To understand the context for this a short history of the Swedish legislation on Co-determination is needed.

3.7   Co-determination in work environment related decisions in Sweden

Research and investigations in occupational health issues in the sixties showed large problems in work environment in Swedish industry. This was an important issue for negotiation between employees and employers organisation and resulted in mid seventies in Co-determination Agreements in different sectors of Swedish industry and in public sector. This was made legislation, *The Co-determination Act* in 1976. This act stated that in all matters that could affect working

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conditions, there should be co-operation between employees and management. One of the areas there this came into practice was the design of new workspaces.

4   CASE STUDY, THE ÖREBRO UNIVERSITY HOSPITAL: The O-building
4.1   The master plan

The master plan for the hospital from 1983 laid out the detailed plan for the development of the hospital. The O-building was the final stage of that plan. A new master plan for the hospital was presented in 1990 also including the O-building.

4.2   The purpose of the building

The building was supposed to house two main activities, surgery and radiology. There were several surgical units that were possible tenants of the building. The decision, however, was to house general surgery, urological surgery, orthopaedic surgery, hand surgery and gynaecological surgery in the building. Very late in the process in 1995 thoracic surgery was added. The unit for anaesthesia and ICU (Intensive Care Unit) were also to be located in the building as support units to surgery. The surgical units should have their own operating theatres and separate support and administrative spaces.

The radiology department is divided in sections and in the building there are sections specialized on thoracic radiology, neuro-radiology, gastrointestinal radiology, skeletal radiology, nuclear medicine and emergency radiology. The building is used for three categories of patients. Both in surgery and radiology; these are emergency patients, planned in-patients and planned out patients/radiology.

Figure 4. Exterior and aerial view of the O-building

4.3   Project start and timeline

The ambition of the project was to create "Care for future generations". This high ambition resulted in quite a high cost estimation of just over 50 million Euros. The project started in 1992 when a revised master plan for the hospital included the O-building in a concrete way on the plans.

In 1993 the report "Friska Sjukhus" [Healthy Hospitals] - a quality program for the new building was published. This report was used as a starting point for design of the new O-building.

In April 1993 the functional brief was presented and discussed with the County Administrative Board and thus presented to the politicians in the County Council. This was an important step as all relevant decision-makers and politicians were present.

The ambition from the head of the hospital was to get a building with high image value. As a symbol for this there were even suggestions to make the building round. The first complete design proposal of the building was presented in 1993. This design was fairly traditional, but more detailed investigations of the site and the interface with connecting buildings ended up in a building with a

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triangular form.

In 1993 a smaller building occupying the site of the O-building was torn down. That same year a new foundation was made for the O-building. This was done in order to connect installations and underground corridors crossing the O-building site.

In 1994 the construction of the O-building started.

In 1995 –1996 there were cut backs in the hospital budget. This had the effect that urological surgery, hand surgery and gynaecological surgery got 2 instead of 3 operation theatres and that thoracic surgery was included in the O-building.

In 1997 the O-building was finished. It had a grand opening with local and regional politicians, leading practitioners and notables from the region. The building was also open to the public.

Fotograf: Nina Broberg

Figure 5. Garden outside the personnel breakout area

4.4   Organization of the design process

4.4.1   A culture of participatory design

The project process was rooted in tradition in the County of Örebro to carry out projects in close co-operation with the users as well as aiming for a high quality building. Traditionally building design projects in the County of Örebro are set up in a close co-operation between core business representatives and the real estate department. The health care units involved organise themselves in design teams to develop useful solutions for their professional activities. The real estate department set up a project organisation to support the building project. Representatives for both these groups meet in a co-operation group to take decisions to deliver to the project steering group. The consulting architects work closely together with the teams in both core business and the real estate department.

The process to develop and design the O-building involved a large number of people. Three main groups covering both user and representatives of the construction project carried out the process, thus we distinguish between the user project, the building project and the co-operation group.

One separate user project was set up for each unit and each user project was populated by a number of actors from the respective units. However, the thoracic unit that was added to the project in 1995 did not have a user group. Due to Swedish legislation and praxis the different unions were

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represented. One person responsible for continuity and strategic issues participated, mostly the nurse who was the head of the unit. The chairman of the department (clinic) participated as well as a representative for the assistant nurses and department of medical engineering. No other representatives for services like janitors or cleaners were represented. The project group was well rooted in and chosen out of trust by the rest of the unit. They reported back at unit meetings.
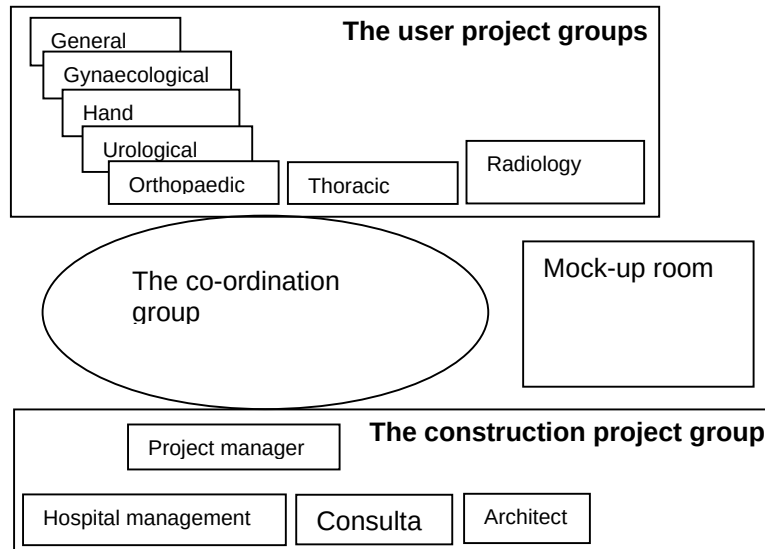

Figure 6. An organisational scheme of the design process.

A construction project manager from the real estate department led the building project. This group also consisted of the architect, technical consultants and representatives from the hospital management.

A co-ordination group was set up as a bridge between the user project and the building project. The head of the unit, the chairman of the department and representatives from medical engineering participated from the user project and architect, construction project manager and sometimes the hospital management participated from the building project. The co-ordination group took decisions regarding the development of the project. In addition to the work in the co-ordination group the architect also worked directly with the different units.

The work done in the user project groups were presented regularly at meetings on unit level. There were large papers on the walls were people could comment on drawings and other material that was displayed. The comments were later given to the architect.

4.4.2 Co-operation in design
4.4.2.1 Surgery

The different units in the user project carried through separate design activities to investigate alternative solutions and articulate the needs of the units. An important arena that all units could use was a room where a complete mock-up of an operating theatre could be build. This was the arena where nurses, doctors and medical technicians could meet with architects and other representatives of the building project and investigate different solutions. The mock-ups were used for simulation there the degree of truthfulness to reality was extremely high and detailed.

Most of the dialogue in the design process took place directly between individuals or group from the user project and the building project and they often arrived at concrete conclusions and suggestions. Decisions, confirmation and policies were then forwarded to the co-ordinating group that had the formal power to take that role.

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4.4.2.2 Radiology

The process of the radiology units was somewhat different. The chairman of the department and the head of medical engineering were dedicated at an early stage to the idea of using new digital technology in radiology. The chairman of department contacted every radiology department in the county to investigate wherever they were willing to convert to digital radiology. This would mean that the County would be the first to connect all hospital in a larger region over a network that could transfer digital x-ray pictures. All five radiology departments came to the conclusion that this would mean a great advantage to them and agreed to participate. They presented this idea to the heads of the hospital and the county politicians and got their support as long as they kept the time and money limits. The original brief for the units however suggested a mixture of traditional technology and digital technology and a step-by-step conversion to the new technology. The manufacturer of digital x-ray equipment – Philips - however took an interest in the developments and was willing to use Örebro as a testing ground for their development work. This situation and the character of the equipment made it not feasible to use the same method of a common testing arena as was done for surgery. In this case the development of technology was done through innovative work in all steps of the chain from Phillips laboratories to the actual radiology unit in Örebro with iterations of information and knowledge between radiology nurses, doctors and technicians on one side and engineers and researchers at Phillips in the other end. The result was that University Hospital in Örebro became the first hospital in Sweden that totally depended on and fully utilised filmless digital radiology technology.

Figure 7. Patterns from X-ray pictures are used for decoration in radiology department, see top of picture.

4.4.3 Important issues in the design process
4.4.3.1 Organization

In surgery the main issue was the change from an organization where surgery was a general resource for the whole hospital and located in a central unit. In the new organisation the surgery was divided into units and organizationally belonging to different departments (clinics). This change was however decided beforehand and was a prerequisite for the new building.

In radiology the big question was the transition of technology. Many operators and nurses feared the new technology and the risk that their professional knowledge should be obsolete. As the more serious development in this direction took place after the briefing process for the building had started it was also a problem for the building project. A step-by-step move of units and a serious educational program was established to meet these problems.

4.4.3.2 Daylight and other comfort issues

An absolute demand from the users was operating theatres with windows and daylight. Some questions were raised from the building project however this could be a problem for certain processes like keyhole surgery or if they not would pull the curtains down most of the time anyway. The

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experiences from the old operating theatres, located in the dark core of a double corridor building from the seventies, was however so definite that no discussion were necessary. The users were also inspired from research in environmental psychology that stressed the importance of pleasing environment both for the sake of the personnel and the patients. Aspects like colour and music in the operating theatre were discussed.

A question related to this was access to outdoor terraces. This was however a trickier question as it was easy to advocate for the hygienic risks of going outdoor when working in a surgical unit. No real excuses came up that could justify outdoor terraces, but still there are such terraces in the completed building to the pleasure of the staff. However, everyone realized that it was a calculated risk and it is now used with a very strong awareness that the hygienic regulations must be followed rigorously. No problems have so far (autumn 2003) occurred that can be related to this.

Figure 8. One of the break-out areas with a terrace

4.4.3.3 Ventilation

An important issue in the operating theatres was however they had such high demands of cleanliness that they needed ventilation with a laminar air flow through the ceiling or could be satisfied with more traditional displacing ventilation. A decision was made that 4 units needed such high degree of cleanliness that the investment was justified. The thoracic surgery however, that came in late in the process, also advocated this need but according to the standard used they did not need such high quality ventilation. At that late time technology and economy also made it impossible to meet these demand.

4.4.4 Comments on the process

From the interviews today we find that the memories from the design process are very positive. Most of those who participated or worked in the units that moved into the building remember it as a positive experience. They are also very appreciative of the project leader of the building project who were very open and tried to meet all wishes with respect. Interesting enough persons in leading position does not remember the process being as smooth as the interviewees remember it.

The head of the real estate company at the time does remember with some uneasiness the turmoil that accidents in thoracic surgery caused at the time. The decision to install the less advanced ventilation in the operating theatres caused serious accusations against the real estate company having caused these accidents by an inadequate design. The head of radiology also remember the tough discussions he had with different professional groups who feared the introduction of digital radiology. We will describe this in more detail later.

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5   THE BUILDING
5.1   General

The result is a triangular shaped building located centrally within the Örebro University Hospital area, se figure 1. It is a seven storey building with a helipad on top. Two of the floors are service floors with nothing but installations.

The triangular shape was derived from the size of the land and because the new O-building needed to connect to the adjacent existing buildings. This applied not only to axis but also to floor levels.

It has a cast-in-situ concrete structure and was built stepwise with the floors first, then the walls. Then, when the building structure was complete all installations were brought in. The pillars have an H-shaped form to allow minor installations within it's' form.

The cast-in-situ concrete structure is a requirement of the SSIK, a governmental agency that monitors hospitals and other public buildings with respect to war and terrorism.

All vertical installations run through shafts and all installations on the floor run along the corridors. No installations run through the operation theatres and they are all fed from the corridors. This was important in order to achieve a high degree of flexibility for future changes.

The building has two full ceiling height installation floors were all main ventilation systems are installed. There are five separate ventilation systems taking care of the different requirements from the activities in the building. There are for example laminar flow systems in 4 of the operation theatres, specifically those used for orthopaedic surgery and general surgery. A central hot air system is also installed for local warming of patients post-op as this enhances their recovery.

The building has a high level of electrical security. The building uses a metal framework that has the function of "Faradays cage" and uses the "Isolated Terra" system. The latter separates the ground in the building from the ground in the power supply system. These two measures protects against magnetic- and electrical disturbances. The building also has two separate power supplies; diesel power generators and a UPS battery back up system.
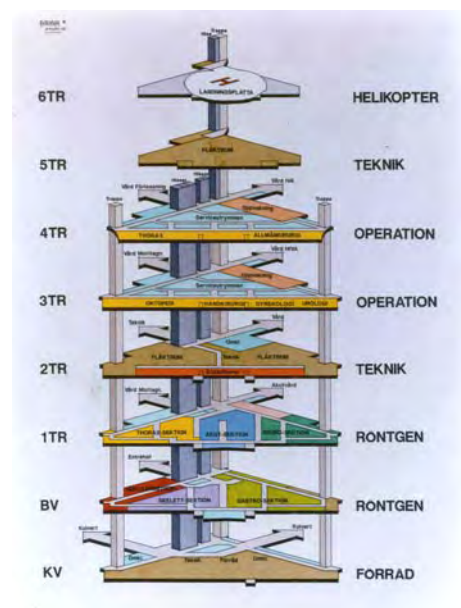
5.2   Organisation of the building

In the basement there are underground corridors connecting to the underground communication systems of the whole hospital. Along these corridors there are separate corridors for main feed/installations of gas, water, hot water etc.

On the ground floor are general hospital communication areas. Corridors connect to other buildings; in order to reach some one has to use covered outdoor walkways.

The emergency entrance of the hospital is also placed in a building directly adjacent to the O-building. From the emergency entrance there is also a direct connection to the intensive care unit.

The major part of the ground floor is used for the radiology department. On the ground floor the radiology department has examination rooms, meeting rooms and offices. The ground floor also has a popular outdoor rest area used by the radiology department.

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The second and fifth floors are service floors.

The third floor houses day-surgery and preparation rooms for this. The day-surgery units carry out surgery where the patient can return home in the evening. This floor also has 4 operation theatres for thoracic and 4 for general surgery. There is also a pre-operation ward currently (autumn 2003) not in use.

The fourth floor has a pre-operation ward and 10 operation theatres. These are orthopaedic surgery 4, urological surgery 2, hand surgery 2 and gynaecological surgery 2.

The top floor is used for the helipad. This is connected with elevators directly to the emergency entrance of the hospital.

Figure 9. The helipad

5.3   Using the building

The daily activities in the building are affected by the type of surgery/radiology that shall be done and whether it is an emergency, planned in-patients or planned day surgery. A typical process for surgery starts when the patient arrives at the O-building. If the chosen surgery is day-surgery the patient arrives at day-surgery reception. The patient is then taken to a preparatory unit. After tests and preparations the anesthetic unit brings the patient to the operation theatre and prepares for the operation. Depending on type of surgery the level of anesthetics are different. After the surgery the patient is the taken back to the anesthetic unit. When the treatment is completed the patient leaves the hospital.

When the patient comes from another department and it is planned, the patient arrives by the aid of the anesthetic department to the relevant surgical unit. At the operational theatre the patient is anaesthetized. Once the surgery is completed the patient is awakened in the pre surgery room.

Anesthetics use a pre surgery room at the O-building. This improves the quality of the preparatory process as there is more than one nurse available to check on the patients during this phase. This solution was tested during the design process.

A typical process for radiology is firstly affected by whether the patient comes as out-patient or as an in-patient. The out-patient is coming by herself and arrives at a reception. The patient is then given a space were he/she can change clothes and make preparations for the examination. The patients have their own spaces were they can control light etc. This is important as they can become more relaxed and adjust the conditions individually. At the radiology department they also have incandescent light as opposed to fluorescent tube light, which gives a warm and comfortable atmosphere. This is important as most radiology examinations imply that clothes are taken of in a more or less public environment. The light character and the small scale with individual spaces for

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change enhance the quality for the patient.

When the patient comes from another department within the hospital they are brought directly to the relevant examination room.

Figure 10. Decorations and colours are always present

5.4 Suppliers

During the planning there was an ambition to keep the number of storage spaces in the O-building to a minimum. Interviewing the nurses today they remember having a feeling that the architect did not really believe them when they estimated the need for storage. The result was too little storage room for medicines, medical equipments and clean linen. As a consequence new ideas were developed by the hospital staff. This has resulted in a supply situation where a number of suppliers deliver material on demand. This is done based on a preset material kit that must be available. Another solution that is used is that the supply chain is totally outsourced to the supplier who owns and is responsible for the storage in the medical unit. The supplier of general hospital material such as syringes etc. has a central storage room where goods are bar coded. The users in turn use their respective bar code when fetching material and via this system the supplier and user can keep track of use and costs. The supplier of bed linen, working clothes and other textiles deliver kits of new material every day. The departments are charged for actual use. Pharmaceutical products are delivered as pre specified products and volumes twice a week.

The above supply systems relieve the hospital staff from a number of support tasks for and are experienced as very positive.

5.5 Experience of use

A number of interviewees did not work in the hospital at the time of design. The difference in appreciation of the building between those who participated at the time and those who did not is not obvious from our interviews.

Most negative comments concern orientation inside the building. The triangular shape of the building is not intuitively understood.

In the interviews the building is however mainly commented in a positive way. It is described as a nice building with nice colours. Especially the different colour schemes used to indicate departments are experienced as both as looking nice as well as supporting orientation. Several interviewees also comment that the nice colours are positive for the patients.

Those that have been working in other hospitals experience the O- building as very nice. A comment was that "when I was working in another hospital I understood how great a workplace we got".

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Another comment concerns the milieu, "it is not only grey, white and with cold light".

The main concern at the surgery department is that the day-surgery work-load has increased. This results in a lot more patient transports than expected. This is due to the fact that the pre-surgery unit is on floor 4 and surgery is being done both on the fourth and fifth floor. This in combination with a shortage of staff and the construction of the O-building with surgical units on two floors is considered a significant problem in the O-building. The handling of sterile goods is a function that is carried out differently in the different surgical units. This resulted in a separate lift for this function and that sterile goods needs to be transported to another building in order to get fully sterilized. This is due to the surgical units different views on how they wanted sterile goods to managed. It is an overall logistical difficulty although not a major problem.

In the radiology department positive comments concern the overall work environment that is considered well design, looking nice and being comfortable. However, ergonomical issues could be further dealt with as there are still problems with backs and shoulder. This might be due to the fact that although major adjustments for the radiology examination are done automatically the final adjustments have to be done by hand. A new stress factor not present before is stress related to malfunction of the computer based systems; this is experienced as frustrating when it happens.

A criticism concerning the building is that is not used at its full potential. It is only used to 1/3 of its capacity. This is however a hospital management and political issue that is related to medical care politics rather than the usability of the O-building.

In sum, the building is considered nice and well-functioning both for staff and patients. The difficulties encountered concerning ergonomics are similar to other parts of working life but compared to other hospitals it is lower. The building has unused capacity and has proven flexible enough during the first 6 years of its use. The issue of usability and views on use that are important for the long-term development of it is presented and discussed in chapter 6.

Figure 11. Pictures from radiology

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Figure 12-13. Ground floor and first floor
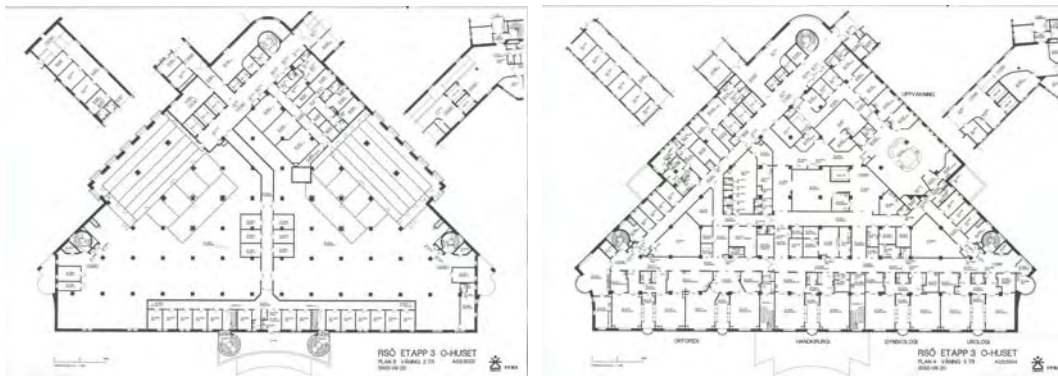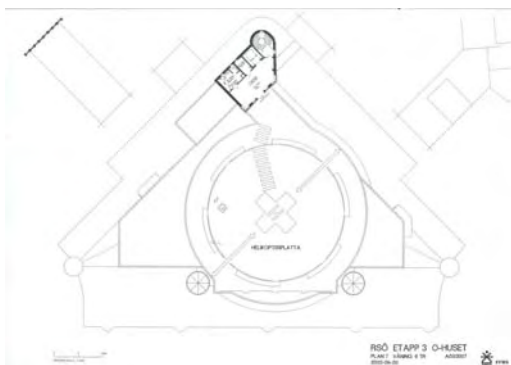


Figure 14-15. Service floor and fourth floor

Figure 16, 17 and 18. Fifth floor and service floor. Below: Roof with helipad.

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6   A THEORETICAL FRAMEWORK FOR THE CONCEPTS OF FUNCTIONALITY AND USABILITY

We can define **functionality** as a property given to an artifact in order to create a **practical effect**. An important effect can be described as **usability**. Product designers suggest two categories of functionality; **technical functionality** and **interactive functionality**. Technical functionality is defined as those properties given to the artifact that makes it function in itself - **operational functionality**, but also those properties given that makes the artifact function as a part of a larger whole - **structural functionality.** Interactive functionality is described as **ergonomic functionality** and **communicative functionality** and is about those properties of the artifact that interact with users of the artifact. Ergonomic functionality refers to all properties of the artifact that affect the more tangible relations between man and the artifact. Communicative functionality on the other hand deals with the more subtle effects that the form and aesthetics of the artifact have in terms of supporting meaning, values, identification or sensory aspects.

In ISO standards three factors are described that determine usability. **Efficiency** means that the artifact allows the users to perform with ease and with little use of resources. **Effectiveness** describes the ability of the artifact to deliver a certain desired effect. The third factor is **satisfaction** that describes the users feeling and attitudes to the artifact and its effects.

We all know that functionality alone does not make a certain artifact usable. The technical and physical properties of the artifact and its theoretical potential to deliver a certain effect do not automatically make it usable in the real world. As a result of the definition of usability it also depends on the **context** the artifact is designed and used in and the **values** of the designers and users. Both context and values change with **time** and **place**.

The above discourse on the definitions of functionality and usability must be made operational in the real world. This is done through the planned set of case studies that we perform in the project. An important step is therefore to reflect on every case to determine whatever the definitions of functionality and usability are usable and helpful in real life situations to guide briefing for buildings and help in post occupancy evaluation of build space. Another aim is to use the cases to further enrich and elaborate the definition of the concepts for a better theoretical understanding.

6.1   How was usability created in the O-building – an operational reflection on the concept of usability

6.1.1   Functionality

Örebro County Council has a long experience as a builder of hospital units. They also have a long relation to consultants in health care design which has given them a solid know-how and experience in how to equip and dimension buildings for their purposes. The tradition in the organization is not to make detailed and voluminous lists of all equipment and building properties in the brief.

The functional brief was more or less developed through work with the mock-ups and through the hands on co-operation with Phillips. Tacit and explicit knowledge embedded in the minds of the users was an important source of information and knowledge. Visits to other hospital were also together with experiences within the building project from other object useful.

The strategies were a little different in radiology and surgery. In surgery **technical functionality** was secured through working with mock-ups. By doing that it was possible to both investigate the properties of every single piece of equipment to make sure they functioned well itself but also worked in the context of the operating theatre. In the radiology departments the functionality was secured through the co-operation between Phillips and the radiology department. The equipments used on the patients in radiology do not differ much from analogue radiology. The big difference is that film is not used in digital radiology which makes a difference in development, handling and storing of the pictures. It also makes a big difference to doctors in terms of diagnostic praxis and effectiveness in operating situations. As the experience of the actual technique was little and some technology did not even exist in reality one defined functions rather than equipments in the briefing and procurement

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process.

In surgery **ergonomic functionality** was secured through extensive use of the mock-up. A number of issues were discovered. As the equipments used on the patients in radiology were rather like traditional equipment existing know-how could be used. New functions in handling and maintenance of the equipments were dealt with in co-operation with Philips.

Communicative Functionality was important in both the operating theatres and radiology. Partly it was a matter for communicating certain values to the patients, partly of symbolic meaning to the staff. Windows in operating theatres, colours and decoration had this double meaning. In interviews we can clearly see how relative these aspects are. It is not before people have been to other hospitals or heared the comments from patients on the environment they realize what a pleasant work-place they have. Having this pointed out to them they feel a certain pride of their work environment.

6.1.2   Efficiency

The process of working with prototyping in the mock-up room safeguarded against solutions that would not work when it came to reality. A semi-conducting floor that fulfilled the functional specifications had a pattern that made sutures, needles and other small items visually disappear if dropped, which could have caused serious hazards. The new organization in surgery is well supported by the building. It is today, due to proximity, easier to be flexible and borrow staff from other surgical clinics if needed.

In radiology the decision to change to digital radiology coincided with an independent demand from the hospital management to save money by cutting down staff throughout the hospital. The new technology made it possible to analyse the work organization and the competence needed in the department. This ended in a new competence structure were more responsibility was given to qualified radiographers and the competence of the radiologists was used in a more efficient way. The new technology made the group of assistant nurses obsolete and allowed less staffing during examination.

6.1.3   Effectiveness

A good example of how effectiveness was allowed to rule over what we maybe could argue would have been more efficient is the total transition to digital radiology. It might have been easier to take it slowly and transform the technology in a pace that would have been more in line with the personnel's skills and knowledge. It might also have been less risky not to stand in the front line of a new technology. However with a procedure of planned transition combined with education of personnel the hospital became a very effective unit when it came to radiology. Due to the late introduction of the new technology in the project there were quite large spaces left empty that originally were meant to be archives.

6.1.4   Satisfaction

It is hard to find anybody that has anything negative to say about the building today. The real estate and service department call the building "the jewel in the crown" and staff in surgery and radiology say their work place is both pleasant and working well. Long distances and a difficulty to orientate due to the triangular floor shape are however mentioned. It is even hard to get people who were involved in the design process to remember the doubts and objections that they once had. We have to interview those who were targets of this dissatisfaction to get a good picture.

One of the major conditions to achieve satisfaction with the new building was to involve users in a very early stage of the process. This was not a novelty in this project. It is a part of the culture in Örebro County Council. Already in the late sixties the first attempts to involve users in the design processes took place and the use of mock-ups as a tool in the design process goes back to the early seventies.

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The surgical departments could have a major impact on the design through this process. The absolute demand on daylight in the operating theatres was a soft issue that could have been questioned. So was the access to balconies. Both demands were met by the project and in the case of the balconies there were no other reasons to meet this demand than to make people happy. The project group merely closed their eyes to the risks it could mean and put a lot of efforts into preventing anything to happen in the use of the balconies by strongly alerting the awareness of hygienic rules.

There were however some serious discussions during the design process and after in both surgery and radiology departments.

Figure 19. A surgical unit

6.1.4.1   Surgery

The thoracic surgery unit was not happy with the decision to give them "ordinary" displacing ventilation as they argued they needed laminar airflow ceilings. Short after moving in there was an increase in infections in the unit and one patient died. This was argued to be caused by insufficient cleanness. The immediate conclusion from the users was that this was caused by, what they regarded to be, an inadequate ventilation system. This attracted quite a lot of attention, not only in the hospital but also in media. Accusations were delivered in different directions and the hospital management and politicians had to investigate the cause of these unfortunate accidents. It was a specially hard time for the real estate and service department that was responsible for the design and functionality of the ventilation system and that also had a part in the suggestion to deny the unit to get what they regarded an absolute minimum standard of ventilation. However, the real estate and service department did not question the relevance of the complaints, but initiated a thorough investigation of the ventilation system and a parallel investigation was done of the procedures of the health care chain in the unit.

There was no evidence at all that anything was wrong with the ventilation system. The investigation of the health care chain, however, proved that the hygienic alertness standard had been less than satisfactory in the unit since they moved into the new building. It was also interesting to note that the unit had for many years operated in premises with displacing ventilation without being aware of it and with no incidents at all.

6.1.4.1.1   Reflections on dissatisfaction in the thoracic surgery

The unit had joined the design process late and did not have the same possibility to have influence on the solutions and therefore had not the same feeling of ownership of the process as the other units. They had one strong demand that was rejected by the project. One suspicion could be that the attitude to moving into the new premises was not positive which probably caused the staff to immediately blame the ventilation system, and indirectly the building project, when accidents occurred. If this dissatisfaction with the project also was to blame for the temporary malfunction in the nursing chain is not possible to know.

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6.1.4.2 Radiology department

The dissatisfaction in the radiology department was of a quite different character. There was a substantial risk to push the new technology as fast as one did. We know from other areas that dramatic changes of technology can cause fear and alienation among professionals that find their traditional knowledge and skill being obsolete. To make such a major change at the same time as a substantial cut down of staff was forced on the unit was risky. A very articulated and resourceful group was the orthopaedic surgeons. They traditionally used the x-ray films to sketch on when planning an operation. To have all images on computer screens would mean a change in procedures to this group. They also feared the quality of the pictures would be of lower quality in the digital format. Other surgeons were however positive as they saw advantages in the new technology for their praxis.

Figur 20. Radiology examination room

The radiology engineers were strongly affected by the new technology as some of their old knowledge might be obsolete and they had to learn totally new thing.

Some assistant nurses in the Radiology department realized that the new technology would make their group obsolete as their work was connected to the handling of film. Radiographers feared the cut down of personnel in connection to the new technology.

6.1.4.2.1 Reflections on dissatisfaction in the radiology

The radiology department is today one of the model clinics in the world. The staff is very aware of the fact that they are working in a clinic that is the state of the art in the area. The new technology has developed in such a way that it is to a tremendous help for surgery of all kinds.

Evidence from interviews shows that despite the serious doubts and fears during the process there was a counterforce in the process represented by the persons who pushed the project forward. The technicians mention the trust in the very skilled colleagues and managers that were involved as a reason why they accepted the solutions despite their fears. The head of the radiology department who was the initiator of the new technology managed to get all hospitals in the region to join in the new technology project and to get approval from hospital management and the public owners. The fact that staff that remained in the organisation got better and more rewarding job content and larger responsibilities was an additional aspect that made the project successful in the long run. A massive education program and a step by step moving into the new premises was the strategy for the project. The openness from the building project and the external consultants when it came to the actual design of the work place also contributed to the acceptance of the total project.

6.2 What do we learn from the design of the O-building?

We can clearly see the importance of participation from this case. Örebro County has a long tradition of involving the users in the design of places for work. It is a natural part of the culture and is not

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regarded as an isolated event.

It is interesting to discuss how this culture of participation has an impact on trust between employees and employer and how that in turn makes it possible to impose even more drastic changes like the change of technology in the radiology department.

From the thoracic surgery department we learn that lack of influence and participation can have severe consequences on the acceptance and perhaps also on performance. From the radiology department we learn that usability to some extent is a subjective feeling that is affected by ones own role in the process, how other aspects develop with time and how the workplace relates to other experiences of work situations.

From this case we might conclude that participation has a large value for performance and satisfaction in the near future after the move in. From the interviews we see that problems during the process was forgotten among the employees but was still in the minds of those who were subjects to the protests. Is this true only if the organisation has a mature culture of participating in these situations or does dissatisfaction during the design stage wear off also in other organisations?

A related question is whatever the culture is the strongest driver for satisfaction or is it the behaviour in a single project?

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Avdelningsfunktionsprogram för Operation – Anestesi – Postop
Regionsjukhuset, Örebro – etapp 3
Orgoplan (konsult för avdelningen)

Presentation (december 1992)
Generalplan
Regionsjukhuset i Örebro, Förnyelse (Etapp3)
Nybyggnad operationshus, Ombyggnad B-huset mm.
Byggnadsförvaltningen, Örebro läns landsting

Rapport (1993)
Friska sjukhus
Kvalitetssäkring i samband med uppförandet av operationshuset i Örebro
Byggnadsförvaltningen, Örebro läns landsting

Informationsbroschyr (1993)
Nybyggnad av operationshus
Etapp 3 vid regionsjukhuset i Örebro
Byggnadsförvaltningen och Regionsjukhuset, Örebro läns landsting

Presentation (februari 1993)
Systemhandlingar
Regionsjukhuset i Örebro
Operationshus
Byggnadsförvaltningen, Örebro läns landsting

24

Presentation (april 1993)

7.2   Interviews

Ann-Christine Nilsson-Lundqvist 2003-10-06
Project leader Real Estate

Ulla Magnusson 2003-11-11
Nurse, vice department head, anesthesia

Lars Ryttberg 2003-11-11
Consulting ortopaedic surgeon

Krister Skarin
Medical technician, Head of division Operating theatres

Håkan Ström 2003-11-11
Head of Real Estate

Sture Karlsson 2003-11-12
Medical technician, radiology

Malin Hedlund 2003-11-12
Nurse, radiology

Fredrik Collin 2003-11-12
Architect FFNS, project leader

Torbjörn Andersson 2003-11-12
Consulting radiologist

7.3   Web-links

http://www.orebroll.se/oll/
http://www.orebroll.se/uso/
http://www.orebro.se
http://www.orebroll.se/landstingsservice/

International Council for Building Research and Documentation
University of Salford, School of Construction and Property Management
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Tel. +44 (0) 161 2955357

Task Group 51: USABILITY OF WORKPLACES

Interim Findings

A particular focus of the case studies has been the processes by which the organisations ensure improved effectiveness and how successfully they manage organisational change associated with the workplace. These processes include usability planning, design and management and processes of workplace appraisal and audit.

The workshops have provided the opportunity of evaluating the application of particular processes and systems and tools for usability. Usability processes have been considered for use in design, planning and workplace appraisal.

A number of specific tools have been evaluated for example community-based planning [1], requirements management (Eco Prop), universal design [2] and particular tools for performance measurement, such as design quality indicators [3].

Through the case studies, the usefulness of these tools has been assessed in the context of the organisations, from a facilities management perspective, with a particular interest in the manageability of the workplace [4].

A number of key theoretical and methodological issues have emerged from the work and will be developed in a forthcoming journal paper.

The industrial partners have benefited from some key practical outcomes of the work:
Sharing knowledge of user experience in the workplace;
Independent review and share best practice;
Feedback from leading-edge organizations;
New knowledge for action:

> user experience – feed-forward
> links between the quality of the environment, health, well-being and productivity in the workplace appraisal methods and techniques;
> Cross-cultural collaboration and information exchange;

Reflection

The task group has also reflected on the working of the task group, with particular attention to team working and collaboration.

Cooper [5] has considered similar collaborative projects as examples of the 'new production of knowledge'. He describes such production as 'short-life inter-disciplinary teams collaborate

by engaging in a dynamic form of research characterised by practical problem solving through negotiated and consensually produced knowledge.'

New knowledge production increasingly transcends discipline boundaries [5,6]. New means of knowledge production, mediated electronically over the Internet [5,7], will be able to unify the cross-disciplinary boundaries working in dispersed locations. Network based collaboration gives organisations the opportunity to share knowledge and hence allows the partners' cooperation and team approaches to problem solving more quickly [8].

Conclusions

Broad conclusions about the nature of usability as a concept have been drawn from the work:

'User experience' encompasses all aspects of the end-user's interaction with an organisation, its services, its products and its facilities;
Usability means 'getting closer to the user', and
focuses on user perceptions of the ease and efficiency with which they can use   the facility – the workplace;
is concerned with the effect rather than intentions or product - it is not PoE;
is a continuing process – it is not a project;
is a time, place, context and situation bound concept;
Increased functionality does not necessarily mean improved usability!;

The results of the five case studies, reports of the associated workshops, and initial findings and conclusions will be published at the symposium. Key issues will be highlighted to generate an open discussion about the application of usability concepts and techniques to assessing buildings and workplaces in use.

References:

[1] Steelcase, 1998, Community-based Planning, Grand Rapids, USA:

[2] Centre for Universal Design, 1997: Universal design principles, College of Design, NC State University;

[3] Gann, D M and Whyte, J K, 2003: Design quality, Special Issue, Building Research and Information, Volume 31 Number 5, September-October 2003;

[4] Alexander, K and Murphy, W, 1993: The Manageability of Buildings, in Alexander, K, ed, 'Facilities Management 1993', Hastings Hilton;

[5] Cooper, I, 2002: Transgressing discipline boundaries: is BEQUEST an example of 'the new production of knowledge', Building Research and Information, Vol 30(2), pp116-129.

[6] Nowotny, H, Scott, P and Gibbons, M, 2001: Re-thinking science: knowledge and the public in an age of uncertainty, Cambridge, Polity Press;

[7] Mansell, R. Wehn, U, 1998: Knowledge Societies: Information Technology for Sustainable Development, Oxford University Press on behalf of the United Nations, Oxford

[8] Rifkin, J., 2000: The Age of Access, Penguin, London;

CIB General Information

INTERNATIONAL COUNCIL FOR RESEARCH AND INNOVATION

IN BUILDING AND CONSTRUCTION

Purpose, Scope and Objectives

The purpose of CIB is to provide a global network for international exchange and cooperation in research and innovation in building and construction in support of an improved building process and of improved performance of the built environment.

The scope of CIB covers the technical, economic, environmental, organizational and other aspects of the built environment during all stages of its life cycle, addressing all steps in the process of basic and applied research, documentation and transfer of the research results, and the implementation and actual application of them.

The objectives of CIB are to be: a relevant source of information concerning research and innovation worldwide in the field of building and construction; a reliable and effective access point to the global research community; and a forum for achieving a meaningful exchange between the entire spectrum of building and construction interests and the global research community.

Members

CIB currently numbers over 400 members originating in some 70 countries, all with an interest in the programming, funding, management, execution and/or dissemination and application of research and technology development for building and the built environment, but with very different backgrounds including: major public or semi-public organisations, research institutes, universities and technical schools, documentation centres, firms, contractors, etc.

Activities

The main thrust of activities takes place through a network of over 60 Working Commissions and Task Groups in 7 scientific areas :

Research, Education and Innovation
Construction Materials and Technologies
Building Physics, Design of Buildings
Design of Built Environment
Organisation, Management and Economics
Legal and Procurement Practices

Each Task Group and Working Commission consists of individual experts in the respective area who meet annually, cooperate in voluntary international research projects, produce state-of-the-art publications and organise global conferences

In this context there are three CIB Priority Themes:
Sustainable Construction
Performance Based Building
Revaluing Construction

Per Priority Theme CIB organises worldwide programme development, RTD agenda's, externally funded programmes and projects plus the incorporation of voluntary commission projects series of state-of-the-art conferences and whatever else is required to take the theme forward

CIB Task Groups (TG) and Working Commissions (W)
(as at June 2005)

Task Groups
TG23 Culture in Construction
TG33 Collaborative Engineering
TG42 Performance Criteria of Buildings for Health and Comfort
TG43 Megacities
TG44 Performance Evaluation of Buildings with Response Control Devices
TG49 Architectural Engineering
TG50 Tall Buildings
TG51 Usability of Workplaces
TG52 Transport and the Built Environment
TG53 Postgraduate Studies in Building and Construction
TG55 Smart and Sustainable Built Environments
TG56 Macroeconomics for Construction
TG57 Industrialisation in Construction
TG58 Clients and Construction Innovation
TG59 People in Construction
TG60 Critical Infrastructure Protection

Working Commissions
W014 Fire
W018 Timber Structures
W023 Wall Structures
W040 Heat and Moisture Transfer in Buildings
W051 Acoustics
W055 Building Economics
W056 Sandwich Panels (joint CIB - ECCS Commission)
W060 Performance Concept in Building
W062 Water Supply and Drainage
W065 Organisation and Management of Construction
W069 Housing Sociology
W070 Facilities Management and Maintenance
W077 Indoor Climate
W078 Information Technology for Construction
W080 Prediction of Service Life of Building Materials and Components
W082 Future Studies in Construction
W083 Roofing Materials and Systems
W084 Building Non-Handicapping Environments
W086 Building Pathology
W087 Post-Construction Liability and Insurance
W089 Building Research and Education
W092 Procurement Systems
W096 Architectural Management
W098 Intelligent and Responsive Buildings
W099 Safety and Health on Construction Sites
W100 Environmental Assessment of Buildings
W101 Spatial Planning and Infrastructure Development
W102 Information and Knowledge Management in Building
W103 Construction Conflict: Avoidance and Resolution
W104 Open Building Implementation
W105 Life Time Engineering in Construction
W106 Geographical Information Systems
W107 Construction in Developing Countries
W108 Climate Change and the Built Environment
W109 Ecospace
W110 Informal Settlements and Affordable Housing

WWW.CIBWORLD.NL

In addition to General Information amongst others about the organization, its member services, the fee system and how to join, plus various special information sections on topics like the CIB Priority Themes and the CIB Student Chapters, the CIB home page contains the following main and publicly accessible sections:

• Newsletters and News articles

• Databases

Newsletters and News Articles

In this section hundreds electronic copies are included of the various issues of INFORMATION, the CIB Bi-Monthly Newsletter, as published over the last couple of years and of incorporated separate recent news articles. Also included is an Index to, facilitate searching articles on certain topics published in all included issues of Information.

Databases

This is the largest section in the CIB home page. It includes fact sheets in separate on-line regularly updated databases, with detailed searchable information as concerns:

• ± 400 CIB Member Organizations, including among others: descriptions of their Fields of Activities, contact information and links with their Websites

• ± 5000 Individual Contacts, with an indication of their Fields of Expertise, photo and contact information

• ± 60 CIB Task Groups and Working Commissions, with a listing of their Coordinators and Members, Scope and Objectives, Work Programme and Planned Outputs, Publications produced so far, and Schedule of Meetings

• ± 100 Publications, originating to date from the CIB Task Groups and Working Commissions, with a listing of their contents, price and information on how to order

• ± 250 Meetings, including an indication of subjects, type of Meeting, dates and location, contact information and links with designated websites for all CIB Meetings (± 50 each year) and all other international workshops, symposia, conferences, etc. of potential relevance for people interested in research and innovation in the area of building and construction.

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